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GASTROENTEROSTOMY.[1]

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Gastroenterostomy at the present day has a definite position in surgery, with a constantly widening of its field of usefulness in the treatment of lesions of the stomach or duodenum.

Twenty-two years ago Wolffler performed the first operation upon a patient where pylorectomy was impossible, and in 1900 Mayo Robson tabulated 1978 cases reported. At the present time gastroenterostomy is performed many times as a routine procedure in certain gastric diseases without much more comment than a cholecystostomy for a diseased gall-bladder.

During these twenty years, however, while the indications for the operation have become more definite, the method of operating and the technique of operation have been the subject of spirited debate. To overcome the confliction of the direction of peristalsis was the first important step, and many modifications in the original operation were made.

Gastroenterostomy was performed at first for the relief of the starvation in obstructive carcinoma of the pylorus, and then, as has happened so often in surgery, a palliative measure was broadened in scope until it became a valuable method of treatment. The one great indication for gastroenterostomy is found in all lesions of the stomach where the contents of the latter are not evacuated. Whether this is due to a malignant or benign obstruc-

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tion, an inflamed or ulcerated pylorus, or atony of the gastric muscle, the retained stomach contents must be provided for by an anastomotic opening.

When carcinoma of the pylorus has progressed so far that its removal is impossible, the last months of the patient may be made more restful by the cessation of vomiting and the ability to assimilate food. In obstruction of benign origin usually consequent upon the healing of an ulcerated area of the pyloric mucous membrane, pyloroplasty is sometimes combined with gastroenterostomy, especially in those cases where a gastric pouch has formed, with loss of the muscle power of the stomach. Where the latter complications do not exist gastroenterostomy is not required, and if performed, soon loses its intended purposes and merely aids in the formation of adhesions.

Bleeding from acute or chronic ulceration of the wall of the stomach frequently offers a positive indication for gastroenterostomy, in order to place the mucous membrane in the region of the pylorus, the most frequent site of ulceration, in a state of partial rest, at least. In acute ulcers the excision of the bleeding point would seem to be the ideal operation, but the consensus of opinion of those of large experience in this work favors a simple gastroenterostomy.

A gastroenterostomy with correct technique will keep the stomach empty, and with the aid of careful feeding sufficient rest can be obtained to enable the ulcerated area to heal.

When a considerable area of mucous membrane surrounding an ulcer is the seat of marked inflammation, or in large erosions or in multiple ulcer direct treatment cannot be done, gastroenterostomy offers by far the best method of procedure. A chronic ulcer, especially in the neighborhood of the pylorus, requires the exercise of great discrimination as to whether a pylorectomy is necessary.

The literature of instances where malignant disease has developed upon the site of a chronic ulcer is increasing rapidly, and such a termination must always be considered and its likelihood an indication for the excision of the pylorus. Gastroenterostomy is too often considered a last resort for a carcinoma of the pylorus causing obstruction, whereas the lesion should have had surgical interference at a time when a cure was possible. But, on the other hand, it must be admitted that in many cases believed at the time of operation to be malignant by reason of enlarged inflammatory lymph nodes, induration about the ulcer, etc., gastroenterostomy has cured the condition and disproved its malignancy.

The various contractions consequent upon chronic gastric or duodenal ulceration may obstruct the stomach and require gastroenterostomy. In hour-glass stomach it is preferable to divide the wall of the organ in the long axis and close in the opposite direction, but when this is deemed inadvisable gastroenterostomy may be performed. In those cases of hour-glass stomach when the con-

striction is near the middle, and two large pouches are formed, a gastrogastrostomy at the most dependent portion of the pouches gives better results than gastroenterostomy.

In cases of extensive dilatation of the stomach with loss of motor power consequent upon a strictured duodenum, the result of ulcer, the anastomotic opening is required. The stomach lessens in size to an extent which will depend entirely upon the contractile power of the muscular coat. When the condition of dilatation has lasted for a long time and has appeared gradually, it is questionable whether there will be any actual lessening in the size of the stomach after operation; but if dilatation has come on very rapidly it will be readily seen that the muscular tone has not been overtaxed, and, therefore, the organ should regain its normal size in a comparatively short time. I would lay stress upon the careful examination of cases of dilated stomach. In some instances this condition is caused by kinking of the pylorus from the downward displacement of the organ due to peritoneal relaxation. In gastroptosis with dilatation of the stomach better results are obtained, in my opinion, by a gastroplication and a gastroenterostomy than by the other methods sometimes used.

In some cases of fistulæ between the biliary tract and the stomach where the extent and density of the adhesions may prevent the separation of such adhesions and the repair of the fistula with safety, gastroenterostomy gives good results. Even where gastrolysis can be performed and the fistula closed, the rest and drainage which gastroenterostomy affords gives additional security to the perfect healing of the stomach. In addition, adhesions are likely to reform, and in such an event the artificial opening prevents the dilatation and other symptoms incident to pyloric narrowing.

In those intractable cases of chronic gastritis where multiple erosions of the stomach are present at the pyloric region, with the mucosa in the neighborhood of the erosion deeply hemorrhagic, and with the occasional "occurrence of profuse or even fatal hemorrhage" (Osler), gastroenterostomy, by placing the pylorus at rest, may cure the condition.

A secretory neurosis of the stomach, with hypersecretion of hydrochloric acid, known in Germany and France as "Reichman's disease," is frequently rebellious to internal medication. In this disease, while the irritation of the highly acid gastric juice induces pyloric spasm at first, yet in most instances atony and dilatation of the stomach occur, and the pylorus becomes eroded and fissured. In these cases gastroenterostomy places the organ at rest and prevents the accumulation of the intensely acid gastric juice with its severe symptoms.

Mayo Robson suggests that, in acute dilatation of the stomach, after lavage has failed, the abdomen should be opened, the stomach emptied and connected with the jejunum, and Weir advises the

same operation in tetany, which is often associated with a dilated stomach and may be caused by it.

The methods most often used at the present time for performing gastroenterostomy are: (1) the anterior operation; (2) the posterior operation, through the transverse mesocolon; (3) opening the gastrocolic omentum above the colon and anastomosing the jejunum to the posterior wall of the stomach; (4) the Roux Y operation, a modification of Wolffler's second method; (5) Kocher's operation.

The anterior operation is now usually performed by bringing the jejunum, not the duodenum, up over the great omentum and transverse colon and suturing to the stomach near its dependent portion. While in the hands of some good results are obtained, yet I believe that it entails greater risk from adhesions and intestinal obstruction than is the case in the posterior operation. Another objection is that the site of anastomosis is made too far above the greater curvature and not at the most dependent portion of the stomach, so essential where the stomach no longer possesses much muscular power. If care is taken, however, the anterior opening can be made nearly as low as the posterior, and, at any rate, it is usually believed that the traction of the small bowel brings the anastomosis to the lowest level, finally. After performing the gastroenterostomy the proximal and distal ends of the loop of the small bowel should be stitched to the stomach, the former at a point higher and the latter at a point lower than the anastomotic opening, preventing, to a great extent, any tendency toward spur formation.

The posterior operation is performed by making an incision in the transverse mesocolon, vertical in direction, to avoid interference with the blood supply of the colon, through which the posterior wall of the stomach is delivered and to which the jejunum is to be attached. The jejunum can always be readily found by passing the hand behind the coils of bowel to the left side of the second lumbar vertebra, where the duodenojejunal junction is grasped. I make it the rule to allow free play of the jejunum by leaving sixteen to eighteen inches of bowel between the anastomosis and the junction with the duodenum. This is done for several reasons: it prevents any kinking of the ligament of Treit, tends to prevent spur formation, and, most important of all, if any subsequent procedures are to be employed, such as enteroenterostomy or Roux's operation, sufficient bowel is left for such operations.

In incising the stomach, as well as the intestine, the incision should first be carried down to the mucous coat, which will then protrude, when, with a pair of tissue forceps, it is grasped and separated at the margin of the wound for some distance from the submucous coat (Robson and Moynihan). The mucous membrane is then cut away to the extent of the length of the wound and about one-half to three-quarters of an inch in width. This prevents the

mucous membrane from pouting into the anastomotic opening and lessening its size, which might interfere during the repair of the wound with the emptying of the stomach, unless the opening is made liberally large. To prevent the slipping of a knuckle of bowel between the margin of the opening made in the transverse mesocolon and the wall of the stomach and consequent intestinal obstruction, as well as to prevent the circular compression of the afferent and efferent loops of the jejunum close to the anastomosis, the margins of the opening made in the transverse mesocolon should be stitched to the stomach wall at one or more points and about one inch away from the anastomotic opening.

The supracolic method merely consists of opening the gastrocolic omentum by a vertical incision, bringing up the jejunum over the omentum and transverse colon and suturing to the posterior wall of the stomach. It has no advantages over the anterior operation and is exposed to the same risk of adhesion formation.

Roux advocates an operation which seems to offer many advantages. The jejunum is divided, 20 to 40 cm. (eight to sixteen inches) below the point where it passed beneath the transverse colon and the distal end implanted into the stomach, the proximal end being sutured into an opening made in the descending limb, which has been sutured to the stomach and about four inches below the latter. It can readily be seen that the "vicious circle" cannot occur, as the bile and pancreatic secretion by the force of gravity will not return to the stomach, unless there is regurgitation of the intestinal contents. The objection that has been raised to this operation is the small opening afforded from the stomach by the rather narrow diameter of the jejunum. Such opening is not smaller, however, than that obtained by the use of the Murphy button or Mayo Robson bobbin, and not any less than the normal pyloric orifice. I have performed the operation without any disagreeable sequelæ at all, but as I have had like results from the same number of anterior and posterior anastomosis, I have not been able to draw any deductions regarding its greater value than the other operations. Roux's method requires some judgment in its use, and, unless performed with great care, subjects the patient to more risk than the simple posterior operation. Roux indicates its use in benign stenosis, gastroptosis, and gastrectasis. As will be seen later, the operation is of great value when the vicious circle has already occurred.

Kocher endeavors to avoid the return of intestinal contents into the stomach and their resulting decomposition and absorption by bringing the jejunum vertically upward, incising it at right angles to its long axis and suturing to the stomach, so "that the proximal portion of the loop passes vertically upward and the distal portion vertically downward, the former opposite to the stomach. A flap is also formed from the intestine to prevent regurgitation into the stomach." I do not believe, however, that the valve persists for

any length of time, nor does the operation prevent the overfilling of the duodenum any better than the posterior operation.

In all of these operations various mechanical devices are used to perfect the anastomosis, of which the Murphy button is, doubtless, the most popular. Personally, I use simply a needle and thread, though in certain cases I have used both the Murphy button and the Mayo Robson bone bobbin. The great advantage of the needle-and-thread operation is that the materials are always at hand, the opening can be made of any length, thus lessening the tendency to subsequent contraction, which may close the opening. The objections to the mechanical devices are the rather small opening allowed and the subsequent contraction of the opening, particularly when the Murphy button or Senn's plates have been used. If too large a button or bobbin has been used, pressure necrosis of the bowel and perforative peritonitis may result.

Of the various other methods of performing the anastomosis, I have had no experience. I do not use the elastic ligature, because I see no advantages to be derived from its use, and it has the objection that we can never be absolutely sure that the ligature will cut through and establish the opening. The Connell suture has also been recommended, but I have never used it, nor do I use the clamps for the stomach and intestine. By the proper disposition of gauze the portion of bowel to be anastomosed, brought out of the abdomen, can be so compressed against the margin of the abdominal wound that no escape of contents occurs when it is opened. There is no danger of bleeding if the coats are well sutured, and if such is feared, Down's instrument could be used in making the openings. Personally, I do not use the cautery knife, believing it to be cumbersome and tending to a needless multiplicity of instruments.

The prevention of vomiting after operation from the formation of the vicious circle has occasioned much thought upon the part of many surgeons. Some deny that they have ever had to deal with this distressing complication, and it is fortunate that this vomiting is not frequently met with; yet that it does occur, even with perfect technique, cannot be disputed. The term vomiting from the vicious circle is applied to that condition where the gastric contents pass into the proximal or afferent limb of the loop, become mixed with the bile and pancreatic secretion and are returned to the stomach. Reflux vomiting (Fowler) is due to the passage of the secretions alone into the stomach, through the new opening, or backward through the partially permeable pylorus. The cause of such severe vomiting has not been determined, some observers having shown that the secretions of the liver and of the pancreas can be led directly into the stomach without impairing digestion or causing vomiting. Fowler[1] believes that the symptoms arising from the vicious circle

[1] Annals of Surgery, November, 1902.

are due either to "the passage of food into the duodenum and its more or less prompt reflux into the stomach, followed by its injection by vomiting, or from distention of the duodenum and a relative stagnation of the stomach contents from motor insufficiency." To correct these conditions after performing the usual posterior anastomosis, Fowler performs enteroenterostomy between the afferent and efferent portion of the loop of jejunum, and, finally, passes a No. 20 silver wire two or three times around the afferent loop between the two points of anastomosis and drawing upon the turns tightly enough to occlude the lumen of the intestine without strangulating its wall. This absolutely prevents the duodenal end of the loop from communicating directly with the stomach.

The question as to whether the enteroanastomosis should be performed in every case must be answered in the negative. I formerly used such a procedure, but at the present time believe that the simple posterior gastrojejunostomy is more rapid, safer, and perfectly efficacious in the great majority of cases, reserving subsequent operative procedures in the event of the establishment of severe vomiting.

The following case illustrates the few points that I particularly wish to emphasize:

Miss M. J., aged twenty-four years, was admitted to the German Hospital on July 7, 1903. Her family and previous personal history presented nothing of interest, nor did her occupation, that of tobacco stripper, have any influence on her condition.

Three years before the first symptoms of gastric trouble appeared with a gradual failing of the appetite, eructations of gas and fulness and distress after taking food. A year later she began to vomit after eating. The vomited material was quite sour, the sourness increasing when the food was retained for a while before the vomiting. There was never any hematemesis. The gastric distress increased and was soon accompanied by a burning pain in the epigastrium, just above the umbilicus, and referred along the costal margins of both sides. This pain was not relieved by eating or drinking. The bowels, which had been regular during the earlier months, became constipated. There was never any diarrhœa.

Her treatment had consisted, after a course of the various stomachics, of lavage practised every alternate day since December, 1902. When the stomach washing was practised in the morning remains of food eaten the night before were found, together with much mucus.

Upon admission nothing of moment was observed by a physical examination. There was tenderness of the abdomen 1 cm. above the umbilicus and over an area 3 cm. in diameter, and also a tender point over the twelfth rib, posteriorly. The stomach capacity was 1500 c.c., the lower border reaching to 1 cm. above the umbilicus when distended.

Operation, July 8, 1903, under ether anæsthesia. An incision five inches long was made through the right rectus, the peritoneum was opened and the stomach appeared immediately below the wound. Numerous adhesions, fibrinous in character, were found around the neck of the gall-bladder and duodenum. The gall-bladder was normal and slightly distended. The stomach was then carefully examined and observed to be slightly enlarged, rather low in position, and the pyloric opening somewhat thickened, otherwise negative.

The intestines were walled off with gauze pads, the transverse colon and mesocolon delivered out of the wound and protected with gauze. The transverse mesocolon was incised and the posterior surface of the stomach exposed and brought out of the wound; a loop of the upper portion of the jejunum was delivered and brought up to the posterior wall of the stomach, to which it was stitched by a continuous Lembert suture, introduced for a distance of about two and a half inches. An incision was then made into the jejunum, about two inches in length, through the serous and muscular coats, and the protruding mucous membrane excised. A similar procedure was performed upon the stomach. The free edges of the stomach and jejunal wounds were united with through-and-through silk suture. The Lembert suture was then continued anteriorly, completing the peritoneal apposition. The abdomen was closed with tier suture.

The patient reacted well from the operation, was free from vomiting until July 13th, when 700 c.c. of dark-green bile was vomited. General condition good.

July 15th. Patient vomited bile during the night. Appetite good; feels better than she has in years. Stitches removed. Incision healed by first intention.

17th. Patient vomited bile, with small portion of fecal matter.

18th. During the early morning the patient vomited; vomitus stercoraceous in character, about 300 c.c., and an intestinal obstruction was believed to have taken place, necessitating a second operation.

When the abdomen was opened the omentum was found adherent to the old scar. These were separated, and the omentum and transverse colon turned upward. This reflection upward carried several coils of small bowel along, and it was found that the proximal and distal limbs of the anastomosed loop were firmly adherent to the posterior layer of the transverse mesocolon, interfering to a marked degree with the peristalsis of the bowel. The adhesions were all separated and such bowel surfaces as were denuded by the separation were sutured with silk or covered with cargile. The gastroenterostomy was apparently perfect. An enteroenterostomy was then performed, 15 cm. (six inches) below the anastomotic opening, in the usual manner. The abdomen was closed by tier sutures. There was some vomiting of a green material upon the two days following operation, which stopped upon the use of lavage.

25*th*. Stitches removed; wound healed by first intention.

26*th*. Patient vomited twice about 300 c.c. of light-greenish material. Wine of ipecac, 10 drops every hour, was given.

27*th*. No vomiting.

31*st*. Ipecac stopped.

August 2*d*. Vomited 300 c.c. of light-green material about 10 P.M. Vomiting cannot be attributed to anything eaten. Placed upon ipecac wine 10 drops every two hours during the day.

7*th*. Vomited small quantity of yellow material. Ipecac stopped.

12*th*. Discharged; condition fine. Is gaining weight, and has not vomited since August 7th.

On September 14, 1903, this patient was readmitted to the German Hospital. She stated that on August 16th, four days after her discharge, vomiting had recommenced, at first of bile and later of food and bile. When admitted she vomited everything given by the mouth, and large quantities of thick, ropy, dark-green material, with a very strong odor. Feeding by rectum was begun, but notwithstanding this, the patient continued to vomit the thick, dark-green material, containing large quantities of bile. On washing out the stomach large quantities of the same material were obtained. It was evident that the biliary and pancreatic secretion were regurgitating into the stomach and causing the vomiting.

Her nourishment was good, notwithstanding the vomiting, proving that the food must be digested in great part, especially as the patient does not seem to have lost much weight. Eyes examined by Dr. W. T. Shoemaker, with no abnormal findings. By a rectal examination the pelvic organs were apparently normal; there were no symptoms or signs of locomotor ataxia.

Operation was performed on September 19th. When the peritoneum was opened the omentum was found universally adherent and there were dense adhesions between the coils of bowel. The gastroenterostomy was exposed and the opening found to be freely open. The enteroenterostomy was exposed, some difficulty being encountered in distinguishing the parts of the anastomosis by reason of the numerous adhesions. When these were separated the anastomosis was found to be in perfect condition, with some sacculation. Adhesions were further separated throughout the abdominal cavity. The entire omentum was ligated and cut away. The gall-bladder was found normal in size, numerous adhesions found around it; stomach normal in size. By means of a pedicle needle a piece of silver wire was passed around the pylorus and tied. Parts were then returned. Abdominal cavity filled with normal salt solution and the abdomen closed by tier suture. The patient was shocked, the pulse barely perceptible at the close of operation. An intravenous injection of salt solution was given before leaving the operating room.

September 20*th*. Patient has vomited bile several times during the day.

22*d*. Buttermilk ordered. Patient feels somewhat distressed in the epigastric region. No vomiting.

23*d*. Patient feels well; no epigastric distress.

29*th*. Ate light diet. No nausea or distress.

October 10*th*. Patient vomited after breakfast.

11*th* to 15*th*. Vomited several times each day; complained of abdominal pain; there was some tympanites. The fourth operation was, therefore, performed, and a coil of small intestine found closely adherent to the parietal peritoneum. The intestines were found universally adherent to each other and to the remains of the omentum, binding together the transverse, ascending, and descending colon and sigmoid flexures and various loops of small intestine, one to another. No portion of the bowel, excepting about five feet of ileum, was free from adhesions. The adhesions were separated, bleeding points ligated, and all denuded surface covered with cargile. The enteroenterostomy and gastroenterostomy were examined and found patulous. At no portion were the intestines collapsed or unduly distended. The abdomen was closed by through-and-through sutures of silkworm gut.

17*th*. Much vomiting.

19*th*. No vomiting.

29*th*. Stitches removed; wound healed without inflammation.

November 2*d*. Patient allowed to sit up in a chair; no vomiting; feels strong.

9*th*. Patient walking about.

13*th*. Discharged.

The patient was home for ten days, when she again began to vomit as before, in the morning bile, later in the day particles of food; would vomit two or three times every day.

On readmission the patient's nutrition is good. On abdomen two scars of former operations; slight distention of the stomach.

The fifth operation was performed December 7, 1903. An incision seven inches long was made dissecting out the last cicatrix, peritoneum opened, and many adhesions found between intestines and under-surface of incision. Universal adhesions were present throughout the intestinal canal; these were carefully dissected free and two holes in the intestine, which were accidentally made, were closed by sutures of silk. Abdomen was filled with salt solution and the wound closed by through-and-through sutures of silkworm gut.

January 19, 1904. Patient apparently entirely well.

This unfortunate woman has, therefore, undergone five operations, one after the other, for the relief of severe vomiting. An enteroenterostomy and occlusion of the pylorus have both failed to relieve her condition. The etherization in each operation has been easy of accomplishment. Every cause for vicious circle or for jejunal reflux seems to have been eliminated, except the influence

of adhesions, which have been met at each operation. The patient gained in weight, even while vomiting, indicating that the digestive power was unimpaired.

From this case and two former ones requiring reoperation I must believe that the formation of adhesions plays the chief part in favoring severe vomiting, by the inhibition of the normal peristalsis and the retention of the bile and pancreatic secretions in the loop of the afferent limb of the jejunum. This limb must be a loop, as we cannot make a rigid tube from the duodenum to the entero-anastomosis, and in the absence of sufficient muscular tone or the presence of obstructing adhesions the secretions must accumulate. The effect of food, the exciting agent of the flow of these secretions, causing vomiting an hour or so after eating, also would seem to indicate the influence of retained secretions. The sagging of the jejunum from the weight of the secretions dragging upon the efferent loop may also have an influence upon the stomach.

My future procedure will be to perform the posterior method of anastomosis or the Roux Y operation, and in the event of vomiting following the former method I will reoperate, divide the afferent limb just below the stomach, and implant it, as in the Roux Y, into the efferent limb some 10 or 15 cm. (four or six inches) below the stomach, closing the shallow sac above close to the anastomotic opening.

The after-treatment of a patient upon whom gastroenterostomy has been performed is of the greatest importance. Shock, vomiting, and pneumonia should be guarded against at the time of operating. I use a hot-water bed, hot bottles, and a cotton jacket during the operation, and have the anæsthetic administered with the greatest care. The arms should never be folded across the chest, thereby impeding respiration.

If shock occurs the usual remedies are administered, and, above all, saline solution by the bowel, at first combined with whiskey, and later intravenously, if the condition of the patient should demand it.

Vomiting is greatly to be feared, and while I usually allow liquid food eighteen hours after the operation, the occurrence of nausea is an indication for its discontinuance, substituting rectal feeding. If vomiting does occur, the best treatment is, undoubtedly, gastric lavage, using small quantities of water at a time, 200 to 300 c.c., and giving absolutely nothing by the mouth.

Peritonitis is unavoidable if the anastomosis gives way, but by the careful use of the needle-and-thread method the danger is minimized and far less liable to happen than with the use of mechanical appliances. Upon the onset of peritonitis, a reoperation is imperatively demanded, the anastomosis strengthened, and the peritoneum washed out. If the shock does not prove fatal, such a patient should usually recover, as the infection from the fasting stomach is not of a very virulent type.

THE NERVOUS COMPLICATIONS AND SEQUELÆ OF SMALLPOX.*

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Smallpox, like other infectious diseases, may present various nervous complications and sequelæ. Indeed, almost the first effect of the variolous poison is observed in the violent frontal headache, which constantly is an early symptom. Sharply contrasted with the many other complications and sequelæ of variola, the affections of the nervous system are not strictly confined to certain stages of the disease itself, not necessarily immediately sequential, nor are they at all related to the severity of the infection. It seems that the variolous process possesses, in a marked degree, the power to awaken latent predispositions to nervous disease, as well as to independently disorder function and create anatomical alterations in the various nervous structures of the body. These affections may be gross anatomical, purely functional, or both. Many cases present a varied clinical picture, which leaves us in doubt as to the exact nature of the lesion, and until further post-mortem examinations and other investigations have bettered our present knowledge, we must be content with collecting the rare and interesting cases for the literature and for future investigations and diagnosis. These complications and sequelæ invade all possible provinces of the nervous system—the brain, spinal cord, and peripheral nerves. Truly, the nervous complications and sequelæ of this loathsome disease offer a most fruitful and little-worked field for research.

Convulsions are often seen in children, and usually precede the eruption. They are mentioned by Trousseau,[1] who endorses the belief of Sydenham,[2] that they possess diagnostic value, especially in the young. Sydenham[3] states that convulsions occur more frequently in smallpox than in any of the xanthematous diseases.

Smallpox often exerts a profound effect upon the pysche.

In order of frequency, as a cause of the febrile deliria and psychoses, smallpox is placed sixth by Berkley.[4] Kraeplin,[5] who is, perhaps, the greatest authority upon this subject, also places variola in the same causative relation.

We may recognize at least four types:

1. Initial delirium.
2. Febrile delirium.

* Read before the Clinical and Pathological Section of the Cleveland Academy of Medicine, October 2, 1903.

3. Collapse or exhaustion delirium.
4. True postvariolous insanity.

The occurrence of initial delirium is quite constant, usually appearing toward the evening of the second or third day; the mind wanders, the speech becomes incoherent, and a true confusional condition develops. Throughout the attack there is much sleeplessness and great disquietude. This delirium differs entirely from that with specifically colored delusions and accompanied by tremors, the delirium alcoholicum, which commonly occurs in inebriates attacked by smallpox.

Seppilli and Maragliano[6] reported three cases of acute mania occurring in smallpox. Two recovered and one remained incurably insane. Trousseau[7] referred to the case of a woman who was seized with an acute mania during the progress of a mild attack of smallpox. She had never before shown any symptoms of mental disturbance. Corlett[8] records the occurrence of an acute mania in the course of a discrete smallpox. The sufferer remained violently insane for six days, when death came.

Grave changes in the mental state, with peculiar speech disturbances, have been observed to follow variola by Welch,[9] Westphal,[10] Otto,[11] Foville,[12] Jaccoud,[13] Riva,[14] Quinquaud,[15] Leudet,[16] Whipham and Myers,[17] Pforzheim,[18] Béhier and Lionville,[19] Long,[20] the writer,[21] and others. These mental changes seem to be a part of widespread changes in the nervous system, and yet sufficiently uniform in their symptom groups and their pathological pictures to deserve separate and detailed description, which will be given later, in connection with two personally observed cases.

The occurrence of true dementia paralytica has been observed to follow variola by Mabille[22] and others. In fact, the writings of Hoppe,[23] Lagardelle,[24] Berthier,[25] Kiernan,[26] and many lesser known observers show that smallpox is a fruitful cause of mental alienation.

Meningitis, fortunately, is a rare complication. It is usually purulent, and probably a metastasis from the skin lesions. Gregory[27] states that it is most liable to occur in children and during the period of suppuration and beginning desiccation.

Reiner[28] has recorded a severe meningitis of the convexity occurring as a variolous complication.

The occurrence of paralysis in smallpox has been commented upon since that exanthem's history passed from tradition to record. Indeed, literature bears out the statement of Landouzy,[29] that "of all the eruptive fevers smallpox is, without contradiction, the one in which paralysis most frequently occurs, either at the onset, in the course of, or at the decline." How frequently it occurs, unfortunately, we have no means of ascertaining. That smallpox is less liable to cause the complication than typhoid fever seems to be the opinion of Landouzy,[30] but from a limited personal observation and an extensive search of the literature, I question the statement.

The nature, origin, and seat of the various paralytic affections attending and consequent to variola are so varied that classification is most difficult. That they may originate in the brain, spinal cord, or peripheral nerves is certain. It is also positive that we may have a combination of two or more of these forms.

Paralysis may occur at the very onset of the infection, at any time during its course, or at any period of convalescence.

The majority of the paralytic affections are, as in other acute infections, of neuritic origin. Landouzy[31] believed that paraplegia was most frequent. I believe, however, that he included the cases of brachial paraplegia, as well as the crural monoplegias, in his consideration. Rejecting these as most likely peripheral neuritides, we place paraplegia of spinal origin farther down in the list of nervous complications and sequelæ of variola.

All are agreed upon the rather fortunate outcome of most of the paralyses of variola.

E. Wagner[32] has observed, on post-mortem examination, evidences of localized non-purulent encephalic disease. And that we may have a non-purulent meningoencephalitis of a simple character complicating variola, I believe, the first case to be reported in this paper will fully demonstrate.

Areas of simple softening and blood extravasations may occur in the brain and produce aphasia, monoplegia, or hemiplegia. According to Immermann,[33] such lesions may remain latent throughout life and be discovered only at autopsy.

Reiner,[34] Landouzy,[35] Edes,[36] Osler,[37] and many other writers mention and some relate personally observed variolous hemiplegias, but if the meagreness of the literature is an index of their infrequency, then they are rare, indeed.

Clinicians have long been aware of the relative frequency of cord affections in variola. The severity of the infection appears to have little to do with their occurrence, since they appear to develop with equal frequency in varioloid. The observed cases have been usually paraplegia, of the motor type, developing in any stage of the disease from the prodromal to a far-reaching period of convalescence. Leroy d'Etiolles[38] has recorded the occurrence of such affections in the stage of incubation before the proper beginning of the variola.

Trousseau[39] observed in cases where severe lumbar pain was complained of in the initial stage that a slight degree of paraplegia was often present. It was manifested by subjective numbness, tenderness, and loss of power. Occasionally the bladder was involved, producing difficult micturition and occasional retention. These symptoms usually disappeared with the appearance of the eruption, but in rare cases remained to the middle of the second week.

Henderson,[40] Westphal,[41] Kahler and Pick,[42] and others state that rarely acute ataxias have been observed to follow variola. It is quite probable that these cases of ataxia are ataxic forms of neuritis,

although many of the cases of pseudomultiple scleroses manifested some ataxia. Henderson's[43] case of postvariolous ataxia presented numbness and tingling of the legs and hands. The skin reflexes and deep tendon reactions were all absent. The patient later recovered his power and station. In the discussion which followed Dr. Henderson's report, Dr. Whipham[44] referred to two similar cases, which, I presume, are embraced in the report of Whipham and Myers.[45] These cases have been looked upon as pseudotabes, the so-called ataxia variolique, but more likely belong to a class of disseminated focal inflammations scattered throughout the brain and spinal cord.

Peter Marie,[46] Sottas,[47] Long,[48] Charcot,[49] and others have observed typical examples of disseminated sclerosis following smallpox. The case of Sottas is quite typical, but it appears from the reports of most of these cases that, while for a time they presented an array of symptoms much like true disseminated sclerosis, they later slowly grew better, thus making a marked departure from the ordinarily progressive course of that disease.

Enough knowledge of the pathological changes has been found at the root of the disorder to demonstrate that we have disseminated encephalomyelitis which, although followed by a sequential sclerosis, has little or no tendency to extend or multiply itself. This subject will again be adverted to.

Westphal[50] recorded a case which was followed by paralysis of the legs and bladder that was due to disseminated foci of inflammation involving the gray and white matter of the spinal cord. Foci of softening in the structures of the cord have been described by Damaschino[51] and Joffroy,[52] Hayem[53] and Landouzy.[54]

Fiessinger[55] remarked the occurrence of acute myelitis appearing as a complication and disappearing with the disease.

Steven Mackenzie[56] has reported a case of poliomyelitis anterior as a sequel of variola. Damaschino and Roger[57] and Landouzy[58] record acute monoplegias in children presenting the clinical picture of acute inflammation of the cells of the anterior horns of the cord.

Although Huchard[59] observed not more than ten paraplegias in 2000 patients affected by smallpox, yet Landouzy[60] states that paraplegia is the most frequent form of variolous palsy.

A rapidly ascending myelitis presenting clinical symptoms of Landry's paralysis has been recorded by a number of authors: Marinesco and Oettinger,[61] Gubler,[62] Leyden,[63] Gros,[64] Chalvet,[65] Marie,[66] Bernhardt,[67] Gros and Beauvais.[68] These cases, as a rule, are rapidly fatal.

F. W. Goss[69] observed a typical case of acute ascending paralysis occurring early in a mild varioloid. It proved so quickly fatal that the patient died four days after the first paralytic symptoms.

Dr. M. Friedrich[70] personally related to me the details of a rapidly fatal case of undoubted ascending or Landry's paralysis, appearing

in the stage of desquamation in a comparatively mild case of smallpox during our late epidemic in Cleveland.

It would appear from Oettinger and Marinesco[71] that the pathological picture of Landry's paralysis may exist in variola in combination with the disseminated myelitis described by Westphal. Indeed, a recent communication appears to have firmly established this fact.

Cases have been described by Vulpian[72] and others of acute ascending paralysis from variola in which a most careful search failed to show a myelitis. It seems reasonable to believe that these cases are polyneuritic in origin.

A careful examination of the literature convinces me that we have occurring as a complication or sequel of smallpox a disseminated encephalomyelitis, which possesses clinical features and pathological changes clearly entitling it to be recognized as a clinical entity, and which occurs with sufficient frequency to demand our special consideration and study. It occurs in other infectious diseases, as the case reported by Ebstein[73] conclusively proves. Ebstein's case is quoted particularly because it complicated typhoid fever and the symptom-complex was identical with that of the variolous cases, and the post-mortem disclosures were more complete and in keeping with the clinical findings.

I believe that these cases have in time past been described as and believed to be the disease which was named by Charcot disseminated sclerosis. Some of the reported cases bear a very close resemblance, but the majority are but coarse imitations. In this connection it is not thought wise to discuss the pros and cons of the question, but to report two personal observations.

I have been able to find fifteen cases in the literature, all presenting:

1. More or less ataxia in the four extremities, usually most marked in the legs.
2. Slowness and awkwardness of movement.
3. Slow, monotonous, explosive manner of speaking.
4. Faulty articulation.
5. A varying degree of mental degradation.
6. A decided tendency toward recovery.

The following personal observations are added to the literature:

To the courtesy of Dr. Martin Friedrich I am indebted for the privilege of examining and reporting this case:

CASE I.—E. L., male, white, aged thirteen years, was normally born in the United States, and of German parents. He had never suffered any severe illness and was considered a large, well-developed boy. His father and mother are strong, healthy people, each giving a good family history. There are four other children in the family, all of whom are well. There have been no deaths in the family, nor history of miscarriages or stillbirths.

Edward was taken sick the last of June, 1902. The family attend-

ant, Dr. Christian Sihler, was called and found the boy's temperature to be 103° F., from which it shortly rose to 104.5° F. Nothing could be found to account for the temperature, and because of numerous cases in the neighborhood, smallpox was suspected. On the fourth day an eruption appeared, and Dr. Martin Friedrich was called in consultation and made the diagnosis of discrete smallpox.

The temperature immediately fell on the development of the eruption, but little secondary fever developed, and the boy was not thought to be very ill. There had been no convulsions or other disturbances of the nervous system, either in the prodromal period or immediately following the eruption. He was sent to the Detention Hospital, where, for the first ten days, he was at no time confined to bed. He ate well, slept well, and did not complain. During the first week in the hospital an abscess developed on the right leg, which, although quite large, caused him little discomfort. He was homesick and anxious to go home, but was put off from time to time and felt very badly about the delay. On July 15th, and on the thirteenth day of his residence in the hospital, his father came to take him home, when the boy was discovered lying on the bed in a stupid condition and could not be aroused. It was thought, perhaps, that he was soundly sleeping, and the father went home without him. The attendant, failing to arouse the boy, informed Dr. Friedrich of his condition, who finally succeeded in awakening him, telling him to undress and get into bed. The boy recalls this and also that the nurse helped him to remove his clothing.

Dr. Friedrich states that his breathing was normal, but the pulse was very slow; the body was limp, with diminution of the reflexes. There were no changes in the pupils. The boy appeared dazed and his speech was slow and hesitating. The next day he was taken home. The stupor continued without any additional symptoms, except the advent of a temperature of 103.5° F. The abscess had been opened several days before this time and was discharging freely, but giving no pain. He remained in a stupor for a period of four or five days, during which time it was almost impossible to feed him; attempts to swallow were accompanied by choking, and it was necessary to feed him liquids with a spoon. From the hesitating speech he passed into a condition of complete aphasia, at the end of four days being unable to speak a word. The neck was stiff and the head slightly retracted; pulse very slow, rarely going above 60. There were no signs of ocular or other paralyses. The pupils were equal, of normal size, but reacted very slowly to various stimuli. The nose, larynx, and retinæ were carefully examined by Drs. Friedrich and Lenker and nothing abnormal discovered. No signs of thoracic or abdominal disease could be demonstrated.

His temperature continued irregularly elevated for a period of two weeks. His aphasia remained complete during this time, but he

seemed able to understand everything that was said to him; could read print and writing, but he was not asked to attempt writing. There was no numbness, or paræsthesia, or loss of sensation. Before his aphasia became marked he complained bitterly of headache, and later, for a period of two weeks, by gestures continued to attempt to convey to his attendants the idea that the ache continued. If he attempted to get up on his feet he would fall, and he also fell out of bed and was unable to get up when down. After he was up and about his gait was markedly ataxic; he staggered like one intoxicated.

He cried a great deal, especially at the end of the second week, and seemed to be very much excited because he could not make his attendants understand what he wanted. Discovering that he cried because of hunger, his attendants began to feed him, when he developed almost a mania for food; would eat until they were afraid to feed him so much, and then shriek with rage and disappointment because he was not given more.

He was aphasic for a period of five weeks, and when speech returned by slow degrees it was distinctly scanning, slow, and thick. His parents relate that he was very much irritated by the presence of other children in the room and would usually order them out, speaking in a manner that was illustrated by the mother as follows: "You-u g-get r-i-i-ght o-u-ut—of-dis- ro-o-o-m—he-e-r-r"—this being the first formula which he seemed able to enunciate. The parents' and physician's account of this peculiar enunciation fits the apt description of Westphal, who said his patient's words came out as though each syllable was "squeezed out." His speech seemed to return rather rapidly; in fact, he soon insisted upon talking most of the time, but it was very hard to understand him, because of his enunciation being so thick, slow, and scanning.

I examined him in the following November: He is a large, well-developed boy, with hydrocephalic type of head. His eyes are prominent, pupils wide, vision normal; no nystagmus, ocular palsies, or pupillary disturbance; palpebral apertures are wide, showing the sclera above the cornea. His gait is peculiar. He walks like a boy who has on a pair of shoes that are too small for him. His station is not good. His parents state that if he receives a slight push he is unable to recover himself and falls. Knee-jerks are quick, no ankle clonus, no Babinski's sign. Left wrist-jerk and elbow-jerks are more marked than the right. His left hand is the seat of a peculiar movement resembling very closely an athetosis; this is particularly marked while walking. Indeed, his gait is worthy of attention and study. The legs are brought forward awkwardly and stiffly; the toes of both feet turn in, which his parents assure me was not the case previous to his illness. The toe of the left shoe is worn more than the right, and it is believed, when not on exhibition, that he drags this foot a little. The right hand hangs normally at his side, while the left is held partially behind him, the palm directed back-

ward and on a line with the middle of the thigh, and at every step is the seat of a distinct athetoid movement involving the wrist and fingers. His parents inform me that this peculiar movement of the hand is often present while sitting still. All characteristics of chorea are absent, and I believe the movement to be an uncontrollable or athetoid movement consequent upon pathological alterations of the brain cells. He occasionally complains of headache.

There are now but few pits to be seen upon the face or body, and in a few months little will remain to show that he has suffered from smallpox. The only evidence of his aphasia at present is a certain thickness of speech and a tendency to stumble over syllables; in fact, he stumbles over the syllables in "United Irish Constabulary" as badly as a well-developed case of paresis. There appears to be, however, a slow and continuous improvement. His parents say that he seems to be as bright in school as before, but that his disposition has changed; that he is cranky and irritable. His father states that when children tease him about his tripping speech he weeps, "instead of punching them," as he formerly did when plagued.

There are some rather novel features in this case; some, indeed, suggesting hysteria; and were it not for the slow pulse, high temperature, and bulbar symptoms, one would be justified in suspecting a neurosis. The headache, slow pulse, and stupor point to an intracerebral pressure, probably due to a simple effusion. Assuming an intracerebral pressure, we have an explanation of the bulbar symptoms.

The aphasia, which was complete, and has left its mark in a halting speech, and an athetosis, point to an undoubted lesion of cerebral tissue, possibly hemorrhagic, or to areas of localized softening. The spinal symptoms of the case are as clearly marked as in Westphal's cases, and the clinical ensemble is certainly of that type.

Case II.—A healthy young woman was taken sick with smallpox the last of May, 1902, and was removed to the Detention Hospital. While there she was under the care of Drs. A. B. Spurney and M. Friedrich, to whose courtesy I am indebted for most of the data of the case. She had a good family history and had been quite healthy herself, with the exception of frequent attacks of night terrors, which still continue.

After the usual prodromal symptoms the eruption appeared at about the fifth day, and, although discrete, was widely disseminated and the pocks large and close together. The secondary fever was not high, but the third day following the eruption she became very delirious. The delirium was not entirely characteristic of the ordinary febrile delirium, since it largely partook of the type of religious mania. Shortly after this delirium manifested itself she lost her speech, swallowing became difficult, and she lay helpless in bed; all four extremities were limp and perfectly useless. The urine and feces passed uncontrolled into the bed. Dr. Spurney states that the

deep reflexes were absent at this time. Quite a number of abscesses developed, some of which persisted long into her convalescence. Her speech was almost entirely absent for a period of over three weeks, when it began to slowly return and had the same characteristics of the preceding case.

It was found when she was able to get out of bed that she was markedly ataxic, so much so that she reeled and staggered like a drunken person, and continued to do so for a period of about three months. The speech gradually returned, but her mental degradation was marked and interesting. She appeared and acted like an imbecile. She did not know enough to go to bed, but when sent to her room would lie down on the floor. She did not even know enough to dress herself, and had to be watched closely to prevent her undressing in public. She remained practically in this condition for two months, when a slight improvement began and continued progressively until one day, while in the chapel at prayers, she seemed to rather suddenly acquire her orientation, and from then on began to gain so rapidly that one month later she was able to go out to the Smallpox Hospital in Newburg and aid in the care of patients. Her improvement has been steady since then, and at the present time she has practically recovered all her faculties.

EXAMINATION. A recent examination reveals practically nothing, except, perhaps, a slight increase of the knee-jerks, a little slowness and tendency to syllabication of words. Her gait is not as good as before; a slight ataxic condition still obtains. The special senses are normal.

There seems to be evidence that peripheral neuritis occurs in smallpox with greater frequency than heretofore believed. It was formerly supposed that the few cases observed were of very limited extent and probably related to gross anatomical lesions of contiguous structures. Postvariolous paralysis of the soft palate and structures of the pharynx quite similar to the more frequent diphtheritic affections of those parts have been noted by Curschmann,[74] Leyden,[75] and others.

Combemale[76] has collected ten cases of peripheral neuritis occurring as complications or sequelæ of variola. In all of his cases some speech disorder was remarked, which he evidently believed to be due to palatal paralysis, or paralysis, or ataxia of the organs of phonation. Limited cutaneous anæsthesia and paralysis of single muscles, like the case of paralysis of the deltoid reported by Curschmann,[77] may rarely occur, and are certainly due to peripheral neuritis. Of great interest in this connection is the case of serratus magnus paralysis occurring during a variola observed by James J. Putnam.[78] This was undoubtedly due to a neuritis of the posterior thoracic nerve. Atrophy followed, and there was no recovery.

Vulpian[79] reported a case of paralysis and anæsthesia of the right circumflex, with weakness in the distribution of the same nerve on the opposite side.

Hitzig[80] has observed a case of double brachial neuralgia, with considerable loss of power; also neuralgia of one arm and shoulder, followed by paralysis of the deltoid alone. All of these cases appeared too early in the disease to be attributed to exhaustion or pressure from decubitus.

Eulenberg[81] has reported a case of partial paralysis of the left facial and both median nerves. The electrical reactions were little changed and recovery ensued.

Rosenblatt's[82] case of crural monoplegia was undoubtedly of peripheral origin, and, as before stated, it is my belief that Charcot's case of right brachial monoplegia, followed by permanent atrophy of the muscles, was also peripheral neuritis.

I find but one case of multiple neuritis following variola in which a post-mortem examination demonstrated conclusively the correctness of the diagnosis; it is reported by P. Grocco,[83] of Milan. The patient, a young man, six weeks after convalescing from smallpox developed all the symptoms of a multiple neuritis, later pneumonia, and finally died.

Gower[84] mentions a case of polyneuritis following varioloid. The patient died of pneumonia six months later, and the purely neuritic character of the paralysis and atrophy was demonstrated. Since he gives no reference to this case, I believe it to be the one reported by Grocco.

Joffroy[85] observed a patient who, while convalescing from a grave confluent smallpox, developed violent pains in the left arm and shoulder, which was followed by loss of power and muscular atrophy. Pulmonary tuberculosis supervened; the patient died, and a careful pathological and histological examination revealed a parenchymatous neuritis.

Charcot[86] has recorded a case of atrophy involving the muscles of the right arm consecutive to smallpox. It is possible that this case was a brachial plexus neuritis. Rosenthal,[87] of Vienna, reported a case of true progressive atrophy that appeared six weeks sequential to variola.

Indeed, the variolous poison or the combined infections which are so violently manifested in this disease may produce disturbed functions and actual degeneration of any part of the nervous system.

Functional nerve disturbances are not uncommon sequelæ to smallpox. They are commonly severe and persistent, but usually recover.

Epilepsy following variola has been mentioned by Bierlingus[88] as early as 1679.

Osler[89] states that rarely epilepsy appears during convalescence from smallpox.

H. E. Armstrong[90] relates a case of "catalepsy," with waxy mobility and afterward rigidity of the limbs and continuance of consciousness, followed by ecstasy, passing into obscene delirium," finally ter-

minating in unconsciousness and death. The patient was a woman, aged twenty-four years, and in the tenth day of a severe variola, with confluent, crystalline eruption.

Dreyfus-Brisac[91] observed an hysterical hemiplegia and hemianæsthesia of the right side disappear at the time of the efflorescence of a varioloid.

To illustrate the profound effects which smallpox may exert in the production of neurasthenia, the following case is related:

Case III.—W. S., an unmarried policeman, born in the United States thirty-two years ago, gives a good family history, excepting the pertinent fact that he was born when his parents were at an advanced age. He states that his mother was fifty-four years old and his father sixty-four years old at the time of his birth. The patient suffered a sunstroke at sixteen years, and from that time has been troubled with frequent headaches. He says that while he has been physically strong, yet has had little endurance. He experienced a severe attack of measles at twenty-two years, and at twenty-eight years a violent attack of *la grippe*, and since has been visited by yearly attacks of the affection at about the same time each year.

Three and one-half years ago he suffered a violent attack of confluent smallpox, and is very badly pitted as a result. He was completely disabled for two months and then returned to light duty, but caught cold and was laid up two months longer, suffering at this time rheumatic pains and remaining unexplainably weak. He again returned to work, when he suffered further relapse of pain and weakness and general indisposition. From then until two years ago, when the final collapse came, he was rarely able to be on light duty more than a week at a time. Shortly before this collapse he had an attack of severe pain in the left upper chest, which extended down the arm to the tips of the fingers and also across the chest. He suffered from several like attacks, but has had none during the past year. At the time of these attacks he was using a large amount of tobacco, but has not used any during the past year. He dates his complete disability to a time when on his "beat" he was seized with a sudden, unreasoning, and uncontrollable fear—a fear that he was going to die, or something terrible was about to take place. He immediately collapsed and was taken home in a carriage, since which time he has been completely disabled. He began losing flesh, became afraid to walk on the street, was unable to ride on the street car. He waxed irritable, restless, and sleepless; hands became unsteady and trembled, gait became reeling, and heart palpitated violently on exertion, and, in fact, without exertion. His condition became so pitiable and his emaciation so extreme that the medical police official and the medical head of the Health Department in the city in which he was an officer decided that he was permanently and totally disabled. He was retired and placed on the pension roll for life.

EXAMINATION. The patient is a strongly built man, and has so far recovered his former weight that he now registers 175 pounds, instead of 130 pounds, at which weight he was retired. His complexion is florid, hair reddish-brown, and face deeply pitted from smallpox. He is extremely nervous and walks with a peculiar, uncertain, reeling gait, typically and picturesquely neurasthenic. His ears are well placed, eyes on a level, features symmetrical, tongue protruded straight, palate highly arched, with torus; palpebral aperture on the left slightly larger than the right, and the pupil of the right eye is slightly smaller than the left. There is no nystagmus, and, to rough test, no ocular palsies. The pupils react to light and accommodation and consensually. The patient states that, although his vision is good, when he reads a short time he becomes mentally confused. He is slightly short-sighted. Knee-jerks rather weak, but equal; wrist-jerks are normal; a slight jaw-jerk is present. No Romberg. Although he reels in walking, it is not a true ataxia. He appears weak in the knees. The hand grasps are interesting. The right at first registers seventy-five, second attempt sixty, third sixty, fourth fifty-five, fifth and sixth attempts fifty. After an interval of about three minutes the best he can do is fifty-five. The heart muscle is normal; pulse rapid. Thoracic and abdominal viscera normal; urinary examination negative.

Among the functional disturbances we are, perhaps, warranted in placing the isolated cases of diabetes mellitus observed and reported by Freiberg,[92] v. Frerichs,[93] and others.

The occurrence of aphasia, with or without associated paralysis as a complication and as a sequel of smallpox, has been observed. Arnaud,[94] Combemale,[95] Saint-Phillippe,[96] Jaccoud,[97] Curschmann,[98] and Myers and Whipham[99] have reported such cases. Whether these aphasias are due, when alone, to actual destruction of the brain tissue is doubtful; that they are purely functional exhaustion or intoxication of the cortical cells of the speech centres seems more probable. Breganze's[100] case of aphasia, which occurred at the height of a variola and was complete until he made a single application of electricity, when speech returned, but remained stammering, is both puzzling and unique. He considered the loss of speech due to a cerebral atony from exhaustion of the nutrition of the cells. Notwithstanding the behavior of the speech in returning very like hysteria, we must consider the vocal halt which remained as confirmatory to his idea of its pathology, adding, perhaps, to his hypothesis the suggestion of a toxic exhaustion of the cells of the cortex presiding over emissive speech.

The following personally observed instance of aphasia in an otherwise uncomplicated case of smallpox in a boy, aged seven years, was recently reported at length:[101]

CASE IV.—E. M., white, was born in the United States, and possesses a good personal and family history. When first seen he

had a temperature of 103.5° F., some coryza, a slight diarrhœa, and had vomited. There was no history of exposure to acute infectious disease, and, being informed by the parents that the child had been eating a large amount of sweets on the preceding day, I took the case to be a gastrointestinal disturbance, and treated it accordingly. On the following day the child suddenly went into violent convulsions and was more or less convulsed for an hour. The temperature was 103.8° F.; on the next day the temperature remained above 103° F., the child was stuporous, with a coated tongue and flushed face. The respiration was regular. The neck was slightly rigid, but no Kernig's sign was present. There was no rash upon the body, nor could the most careful examination disclose other signs of disease. He was thought to be in a state of meningismus of gastrointestinal origin. His condition remained unchanged, running a temperature of from 103° F., to 105° F., until the morning of the fourth day, when the characteristic eruption of smallpox appeared upon the face and calves of the legs. The eruption was discrete, frank, and classical. The temperature immediately fell and the child became conscious, but it was observed that he did not talk. He appeared to understand, but could not or would not speak. A very slight secondary fever followed, and the patient made an uninterrupted recovery. For a period of over three months the child never spoke a word. He seemed to have forgotten all the language he had ever learned. His hearing was perfect; the movements of his tongue, palate, and vocal cords were normal. He learned readily enough, and in the course of six months was speaking with almost as much fluency as before. It was impossible for obvious reasons to classify his aphasia.

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A CASE OF TYPHOID FEVER PRESENTING AN ARTERIAL COMPLICATION—PROBABLY AN ARTERITIS.

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Among the protean complications and sequelæ of typhoid fever, those connected with the circulatory system are of great interest. They were recognized at least as long ago as 1806, when Hildenbrand,[1] in an epidemic of typhoid at Cracow, observed some cases in which

[1] Ueber den ansteckenden Typhus, etc., 8°, Wien, 1810, p. 310.

gangrene of both extremities resulted. Since that time similar cases have been reported and have been explained as due to venous thromboses or emboli. In 1851 Fabre[1] suggested that autochthonous arterial thrombosis might account for some of these instances, and subsequently different observers, especially the French, have described the symptoms of thromboses of this variety. Some of the apparent cases, however, occurred in young individuals in whom a complete recovery of the affected part ensued. The following case is one of this nature. In these instances it is suggested that an arteritis only existed, which caused the pulse to be so much obliterated that it was merely not felt. A subsidence of the arteritis restores the patulency of the bloodvessels' lumen and the volume of the pulse is consequently increased, returning generally to its former condition.

The symptoms presented by these cases have been especially well given by Bariè,[2] Potain,[3] and Sallès,[4] but the recent publication of Thayer's[5] article renders a detailed discussion of this subject unnecessary. The symptoms in brief are those of "pain, heat, tenderness, swelling, and even resistance in the course of the artery, with diminution or disappearance of the pulsations and coldness or blueness of the extremity." A complete recovery may be noted in a few weeks, "with the disappearance of all symptoms and return of pulsation, not only in the peripheral, but in the affected vessels."

Typhoid fever; severe infection; two relapses; an arterial complication in the right upper extremity on the forty-first day of the disease; gradual recovery, with complete return of pulsation in the affected bloodvessels.—P. B., aged nine years, was first seen by me December 2, 1900. He complained at this time of headaches and general weakness. His family history was negative. He had never been a strong child, had suffered much from asthmatic attacks since infancy and was very susceptible to colds. The winter previous he had spent in California without apparent great benefit. Of the ordinary diseases of childhood he had had measles, mumps, and whooping-cough. He thought his present illness began two weeks before I saw him, when he first complained of headaches on coming home from school. Nothing especial, however, was thought of this symptom, and he still kept up and about, although three days ago he said he felt quite weak. One day ago he went to bed, at which time his mother said

[1] Cas de gangrène et séparation complète du pied dans le cours d'une fièvre typhoïde, Abeille méd., Paris, 1850, vol. vii. pp. 242, 243; and Gaz. méd. de Paris, 1851, 3 S., vol. vi. pp. 539–540.

[2] Contribution à l'histoire de l'artérite aiguë consécutive à la fièvre typhoïde, Rev. de méd., Paris, 1884, vol. iv., 1, pp. 124–149.

[3] De l'artérite et de la gangrène sèche dans la convalescence de la fièvre typhoïde, Gaz. d. hôp., Paris, 1878, vol. li. pp. 537–539; and De l'artérite transitoire des membres inférieurs dans la convalescence de la fièvre typhoïde. Bull. méd., Paris, 1890, vol. iv. pp. 845, 846.

[4] Note sur un cas d'obstructions artérielle au cours d'un cas de fièvre typhoïde chez l'enfant. Lyon méd., 1893, vol. lxxii. pp. 77–82.

[5] On Arteritis and Arterial Thrombosis in Typhoid Fever. New York State Journal of Medicine, January, 1903.

he seemed quite feverish. He had had no epistaxis, nausea, vomiting, or diarrhœa.

On examination he was a rather weakly developed and poorly nourished boy. The lips and mucous membranes were of a good color; the tongue was coated with a thick white fur; the temperature was 101.8° F., while the pulse was 100 to the minute, regular in force and rhythm, and of good volume and tension. The lungs were negative on examination. At the apex of the heart a soft systolic murmur was audible, which was not transmitted outward, but was heard with increasing intensity on passing upward, being loudest at the pulmonic area. The abdomen was not distended, and no rose spots were observed, but on palpation pain was complained of, not localized, but general over the entire abdomen. The spleen was not palpable. A dried blood specimen was obtained for a Widal reaction.

On the following day the report from the Widal was negative. The pain over the abdomen still continued, but was, as before, not localized. Some distention was now first noted, which subsequently proved very obstinate in not yielding to the various means employed for its relief. Because of these abdominal symptoms, leukocyte counts in the morning and evening were taken. They resulted in readings of 7800 and 7400, respectively. No rose spots were seen until the next day, and the spleen was not palpable until December 12th. The patient was ordered cold baths first, but as he resisted the taking of them so strenuously, cold sponges were next given every three hours if his temperature was over 103.5° F. These also had to be abandoned for a like reason, and cold packs were then tried. If they failed to bring about a satisfactory reduction of the temperature, cold sponges were resorted to and generally proved effectual.

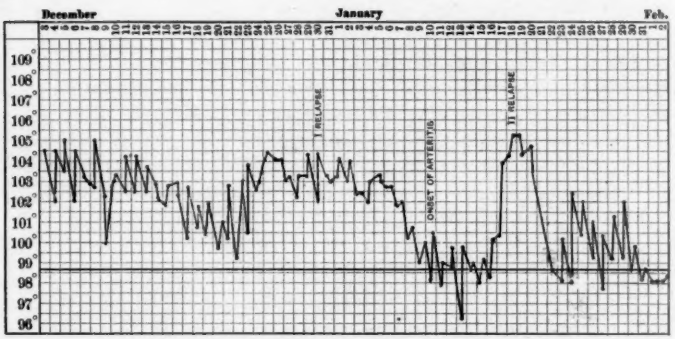
In the matter of feeding great difficulty was encountered, as he objected to taking anything, and the nurses had many a struggle to get him to swallow even a small quantity of liquid nourishment. At one time milk, which was first given him, had to be entirely substituted by broths and egg albumen, as he had a tendency to vomit curdled milk and pass curds in his stools, even with the milk greatly diluted with lime-water. On December 22d, the twenty-second day of his illness, the temperature, which had been gradually falling, reached 99.2° F., and we hoped for a speedy recovery, but a relapse set in, with a temperature of 103.8° F., at 8 P.M., on December 24th, and a subsequent new crop of rose spots. The spleen was not apparently palpable, but he did not permit us to make a satisfactory examination. With the relapse he had a marked bronchitis—sibilant, sonorous, and coarse moist rales being heard everywhere over both lungs, especially the right. During this attack warm packs were tried, as he struggled and resisted so against the cold ones, and was frequently quite exhausted after one had been given him. As they seemed beneficial in lowering the temperature, they were continued throughout the course of the disease.

His condition remained satisfactory until January 5th, the fourteenth day of his relapse, when he became quite delirious. At this time his pulse was very small in volume and thready, 124 to the minute. On an examination of his lungs there was slight relative dulness from the angle of the spine of the right scapula, and the breath and voice sounds were here somewhat harsh. Under the stimulation of whiskey and strychnine, the pulse became again full and strong, and later the delirium left him, and the lung symptoms cleared up. The temperature reached normal on the thirty-ninth day of the disease and the eighteenth of his relapse. Two days later, on the evening of the forty-first day, he complained of numbness and tingling of the right index finger. The right radial was of the same force, rhythm, volume, and tension as the left radial, and no swelling or tenderness could be made out along the course of the right radial, brachial, or axillary arteries. There was no stiffness of the right index finger, and movement of the arm did not cause the slightest pain. Uncertain as to what this symptom exactly foreboded, I ordered the arm to be immobilized, and left the patient, thinking the outcome would be a neuritis or an arterial thrombosis. On the following day, January 11th, the right radial pulse was distinctly smaller in volume than the left, but differences between the axillaries and brachials could not be made out. The numbness and tingling had now been transferred mostly to the elbow, and there was also some pain radiating up and down the course of the brachial artery. There was no swelling or sensitiveness to pressure anywhere in the arm. The next day, January 12th, the pulse was wanting in the right radial, brachial, and axillary arteries, which, on account of the patient's emaciation, could be well felt. The skin overlying them was somewhat swollen and looked red and inflamed. Much pain was complained of on palpation, and the axillary and radial arteries had a hard, cord-like feel. The right upper extremity was distinctly colder than the left, and there was some blueness of the finger-nails. The patient's condition otherwise was good. In twenty-four hours the hand became still colder and had a mottled and cyanotic appearance. Dr. William Porter, Jr., of Hartford, who saw the case frequently in consultation with me, and I now became very apprehensive lest gangrene might set in. On January 14th we could get the axillary pulse, but could not feel any pulsation in either the brachial or radial arteries.

For two days his condition remained about stationary, during which period his temperature more nearly approximated the normal, there being but a slight evening rise. But at the end of this time, on January 16th, his temperature rose from 98.2° F. at noon to 100.8° F. at 4 P.M., while his pulse rate increased from 80 to 90 per minute. Coarse mucous rales were heard on this day over the entire right lung, and over the cardiac area a loud, blowing, systolic murmur was plainly audible, being loudest at the aortic area, where it almost completely obliterated the first sound. On examining the abdomen the super-

ficial veins seemed especially prominent. There was much distention and tympanites, which prevented the spleen being palpated for. The arm was extremely cold and the finger-nails intensely cyanotic. A fresh crop of rose spots were visible on the following day.

The next few days he grew gradually worse, and soon became intensely delirious. The temperature on January 18th and 19th reached 105.2° F., but thereafter fell slowly until it was 103.5° F., on January 20th at 8 P.M. From this time on until January 22d the temperature was not taken, on account of his extreme delirium and restlessness, which nothing at our command could entirely control. On January 21st the emaciation was so marked, the weakness so intense, the delirium so extreme, and the pulse so small, irregular, and thready that dissolution seemed imminent. The respirations were Cheyne-Stokes in character, the urine was passed involuntarily, and the abdomen was extremely distended. The bowels had not moved for three



days. Under stimulants he rallied somewhat, but the delirium remained. In the next twenty-four hours his condition, though desperate, was a trifle improved, as the pulse was then more regular, and there was no longer Cheyne-Stokes respiration. Food of all kinds was refused, and he was occasionally with difficulty kept in bed. His mouth was dry and parched, sordes covered his lips and tongue, and his breath was foul. There was no change in the arm, save that the cyanosis had disappeared and the difference in temperature, as compared with the left arm, was almost unappreciable. On January 23d, the following day, his delirium ceased, he was able to take some food, and an enema was slightly effectual, much gas being passed. The prognosis became decidedly more favorable.

From this time on his improvement was rapid. The symptoms in the right lung cleared up, and his pulse became good and strong and much reduced in frequency. There was still no pulsation in the right radial and brachial arteries. He was seen on January 26th by Dr. E. G. Janeway, of New York, who expressed a most hopeful

prognosis. The patient's subsequent history was one of rapid progress. On January 31st his temperature became practically normal. Four days later I placed him on a soft diet, and on February 13th, thirty-five days after the onset of the arteritis, I first noted a return of pulsation in the right radial and brachial arteries. The pulse in each was slightly weaker and a trifle slower than in those of the left arm, but in three days I could detect no difference between the two sides. On this day he was placed on solid diet and was allowed to sit up. Shortly thereafter he was permitted to get up and walk about, and I released him from my care.

The urine examinations were negative throughout the course of the disease. I very much regret that I was unable to have another Widal reaction taken.

In considering this case, it seems best to regard the arterial complication as one of the so-called peripheral arteritides, as the symptoms so nearly correspond to those of this nature. The disappearance of the axillary pulsation and its speedy subsequent return may, however, be taken as an indication of the displacement of an axillary thrombus and its later lodgement in the bloodvessels of the brain. This would account for the extreme delirium, but the complete re-establishment of the radial and brachial pulsations is against the view of thrombus formation, and the symptoms of delirium may be well explained by the occurrence of his second relapse.

THE OCCURRENCE OF CELLS WITH EOSINOPHILE GRANULATION AND THEIR RELATION TO NUTRITION.[1]

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Many facts are known concerning the activities of the various wandering cells of the blood, yet the significance of few phenomena which they exhibit is clearly understood. Since Cohnheim showed that the polynuclear leukocytes migrate from the bloodvessels, numerous observations have demonstrated how important is the part played by these cells in the inflammatory changes which follow the invasion of bacteria. Nevertheless, we are ignorant of what they accomplish in resisting invasion of the body. Metschnikoff and his pupils believe that the polynuclear leukocytes with neutrophile granu-

[1] The present investigation has been conducted with the aid of a grant from the Rockefeller Institute for Medical Research.

lation resist the infective agent by ingesting and destroying it, while other observers, notably Büchner, maintain that the leukocytes furnish something to the fluids which destroys the micro-organism before it is engulfed. The functional significance of the peculiar granules which stud the protoplasm of these polynuclear cells is obscure. Much less is known concerning the activities of a second type of granular leukocyte, the so-called eosinophile cell, and almost nothing is known of its functions. A short survey of its occurrence in various vertebrate species will furnish some indication of its importance.

It is well known that the studies inaugurated by Ehrlich have demonstrated in the leukocytes of the blood distinctive granules which exhibit peculiar affinities for certain dyes or for a whole group of chemically related dyes. Those dyes of which the staining principle is a base distinguish the granules which are characteristic of certain cells. Another kind of granule is stained only by acid dyes. Neutrophile granules, according to Ehrlich, are stained by the neutral mixture of an acid and a basic stain. By the size of the cell, the shape of its nucleus, and the character of the granules scattered in its protoplasm, the various cells of the blood are classified.

By the microscopic study of fresh blood, Wharton Jones[1] was able to distinguish cells with coarse refractive granules, which many subsequent observers believed to be droplets of fat. These coarse granules occupied the attention of Ehrlich[2] at the outset of his studies upon the staining reactions of protoplasmic granulation. He demonstrated that they are readily stained by all acid dyes, but have such a marked affinity for eosin that when treated with various mixtures of this stain with other acid dyes, they take up it alone. In human blood these so-called eosinophile cells contain a polymorphous nucleus and are actively amœboid, resembling in these characters the more numerous leukocytes, which contain finer neutrophile granules. Eosinophile leukocytes were found by Ehrlich not only in the blood of man and other mammals, but in that of the frog as well, while subsequent studies have demonstrated that they are very widely distributed in the animal kingdom.

Zoological Distribution of Cells with Eosinophile Granulation. Comparative studies of Hirschfeld[3] and others have shown that two types of leukocyte with polymorphous nucleus, are present in the blood of all mammalian species. That variety which in almost all mammals constitutes a majority of the white corpuscles and migrating from the bloodvessels plays a very important part in inflammatory processes is provided with relatively fine granules, which exhibit an affinity for acid dyes. Since the common polymorphonuclear leukocytes of human blood contain granules which ex-

[1] Philosophical Transactions, London, 1864, p. 63.
[2] Verhandlungen der physiologischen Gesellschaft, Berlin, 1878-79, No. 20.
[3] Virchow's Archiv, 1897, vol. cxlix. p. 22.

hibit a peculiar reaction to a mixture of certain acid and basic dyes, but have a well-marked affinity for acid stains, they have been designated by Kanthack and Hardy[1] finely granular acidophile or oxyphile leukocytes. The amphophile granules of Ehrlich present in the polynuclear leukocytes of rabbits are stained by both acid and basic dyes. According to Hirschfeld, the more common polynuclear leukocytes of one mammal, the white mouse, exhibit no granulation, but Ehrlich and Lazarus[2] are inclined to doubt this statement.

Common to all mammalian species examined by Hirschfeld are leukocytes with coarse, acidophile granules. These granules usually exhibit an especial avidity for eosin and are stained by it alone when treated with mixtures containing other acid dyes. Hirschfeld has found that the coarse, acidophile granules of a few animals exhibit a slight modification of this reaction. In the dog and in the cat they take a mixed tint when treated with eosin and aurantia, while in the horse they are stained by eosin and indulin in combination.

Grünberg[3] and Meinertz[4] have studied the white corpuscles of birds, reptiles, amphibia, and fish by the methods introduced by Ehrlich. Small mononuclear cells, with basophile protoplasm free from granules, the lymphocytes of mammalian blood, occur in the various species examined, and forms with polymorphous nucleus are almost constantly found. The latter often contain granules which exhibit an affinity for acid or basic dyes. Cells with acidophile granules are very widely distributed, and in some birds and reptiles constitute a majority of the white corpuscles present in blood. In birds occur two varieties of acidophile granules, both of which show a strong affinity for eosin: (*a*) round or oval bodies, and (*b*) peculiar, elongated, spindle-shaped, or crystalloid particles. The latter occur in all birds and in certain reptiles. In the frog the greater number of polynuclear leukocytes are free from granulation, but a minority are studded with round, eosinophile bodies; crystalloid forms are absent. In fish the characters of the white corpuscles and of the granulation they exhibit are very variable. Acidophile granules are frequently found, but often differ in size, shape, and staining reaction from those of higher species. Certain Teleostean fish, for example, Gobio fluviatilis (Mesnil)[5] and Perca fluviatilis (Mesnil and Meinertz), possess no granular leukocytes.

The constant presence among mammals of two types of polynuclear leukocyte, one type being constantly more numerous than the other, suggests the possibility that each form has a peculiar functional significance. In lower vertebrates, namely, in birds, reptiles, amphibia, and fish, this constantly recurring relation is not present.

[1] Journal of Physiology, 1894, vol. xvii. p. 81.

[2] Normale und pathologische Histologie des Blutes, Nothnagel's spec. Path. u. Ther., 1900, Bd. viii. Teil, 1.

[3] Virchow's Archiv, 1901, vol. clxiii. p. 303.

[4] Ibid., 1902, vol. clviii. p. 353.

[5] Annales de l'Inst. Pasteur, 1895, vol. ix. p. 301.

Moreover, the color reactions first described by Ehrlich, being doubtless dependent upon certain chemical or physical peculiarities of the specific granulations, afford no proof that structures in widely separated species are anatomically or functionally homologous.

Hence, while the eosinophile cells of mammals, bearing a constant relation in different species, are, doubtless, analogous structures, even though they occasionally present slight variation in their staining reactions, they are not necessarily comparable in function; and other characters to the cells with acidophile or eosinophile granules of lower vertebrates. Such assumption seems to have been made by several writers, who have studied, experimentally, the activities of certain granular leukocytes in frogs and in fish.

Cells with eosinophilic granules form in man a small proportion of the total number of leukocytes; their relative number has been found somewhat variable. Ehrlich[1] has stated that they usually constitute from 2 per cent. to 4 per cent. of the leukocytes, and rarely reach as much as 10 per cent. The figures given by other observers vary within these limits. Zappert,[2] who has very carefully counted the eosinophile leukocytes of healthy individuals, finds the proportion noted by Ehrlich, but, preferring to estimate their absolute number, states that 50 to 250 are usually present in one cubic millimetre of blood, though they may reach 700. In children he found that they are usually more numerous than in adults.

In certain mammals the numerical relation of the eosinophile leukocytes to other forms varies within wider limits. In few species has the proportion been accurately determined. Nevertheless, in two widely separated mammals, namely, in the rabbit and in the dog, accurate counts have been made in the course of repeated experimental studies. Kanthack and Hardy found 1 per cent. to 2 per cent. of eosinophile (oxyphile) cells in the blood of the rabbit; Tallqvist and Willebrand,[3] 0.5 per cent. to 2.8 per cent.; Brinkerhoff and Tyzzer,[4] 0.5 per cent. to 1 per cent. The proportion of eosinophile cells in the dog's blood shows greater variation, and the normal average is higher. In fifteen animals, counts made by Tallqvist and Willebrand varied between 0.2 per cent. and 8.1 per cent., the average being 5.3 per cent. In ten animals Dawson[5] found a minimum count of 2.6 per cent. and a maximum of 21.6 per cent. The individual counts which Dr. Dawson has kindly placed at my disposal are as follows: 6.6 per cent., 12.2 per cent., 3.2 per cent., 2.6 per cent., 21.6 per cent., 4.6 per cent., 5 per cent., 10.8 per cent., 9.4 per cent., 2.6 per cent.

In several instances the count is so much above that obtained from the other animals and from those studied by Tallqvist and Wille-

[1] Charité-Annalen, 1888, vol. xiii. [2] Zeit. f. klin. Med., 1893, vol. xxiii. p. 227.
[3] Skandinavisches Arch. f. Phys., 1900, vol. x. p. 37.
[4] Journal of Medical Research, 1902, vol. vii. p. 178.
[5] American Journal of Physiology, 1900, vol. iv.

brand that the presence of some pathological process to explain the apparent eosinophilia has been suspected. The frequency with which dogs are infected with animal parasites is well known, and uncinaria caninis is found with great frequency in the small intestine. With these facts in view, I have studied the blood of ten apparently healthy dogs, and have subsequently examined the intestines and other organs.

TABLE I.

No.	Leukocytes in 1 c.mm.	Eosinophiles in 1 c.mm.	Parasites in small intestine.
1	15,100	1208 = 8.0 %	U. caninis (3), tænia cucumerina (10 grm.).
2	22,350	939 = 4.2 "	U. caninis (25 to 50) and several tapeworms.
3	16,600	880 = 5.3 "	U. caninis (3), ascaris marginata (1), and small tapeworms in large numbers.
4	15,800	632 = 4.0 "	U. caninis (12) and several tapeworms.
5	10,700	567 = 5.3 "	T. cucumerina (large amount), A. marginata (3).
6	15,400	493 = 3.2 "	T. serrata (large amount).
7	14,200	454 = 3.2 "	Several small tapeworms.
8	16,400	328 = 2.0 "	A. marginata (10) and two tapeworms.
9	19,700	197 = 1.0 "	U. caninis (3).
10	5,800	24 = 0.5 "	

The figures are inconclusive, since in no instance does the proportion of eosinophile cells equal that noted by Dawson. Nevertheless, they afford a basis for further comparison and suggest, at least, that the absolute number of eosinophile cells bears some relation to the number of animal parasites within the intestinal tract, especially when it is noted that the smallest number of eosinophile cells was found in two animals, one of which contained three parasites (No. 9), while the other (No. 10) was free from infection.

METHODS. Few observations have been made upon the occurrence of eosinophile leukocytosis in lower animals, and while in a few instances experimental eosinophilia has been produced, the progress of the phenomenon has seldom been recorded by repeated differential counts, which are very laborious and time-consuming. In order to avoid, in some part, this difficulty, and at the same time to obtain a great number of observations upon the behavior of the eosinophile cells under a considerable variety of conditions, I have adopted the simple method of counting the leukocytes in fresh blood. Hardening and staining being obviated, the results are of necessity obtained without delay.

A drop of blood is allowed to spread between cover-slip and slide and is immediately examined with the oil immersion lens ($\frac{1}{12}$ obj.). Certain precautions are essential in order to make the white corpuscles so conspicuous that none are missed in counting. Of first importance is the use of artificial illumination, preferably that from the so-called Welsbach burner, since by this means the refraction of the corpuscles is increased and the characters of their granulation and of their nuclei become evident. A diaphragm with a rectangular opening is so inserted into the eye-piece of the microscope that the

upper and lower segments of the field are obliterated and the count, performed with the aid of a mechanical stage, is confined to a somewhat narrow equatorial zone. It is obviously necessary to use only those specimens in which the blood is spread into a moderately thin layer, and to make the count immediately after the blood is drawn.

If these precautions are taken, on the one hand, few, if any leukocytes, are omitted from the count, while, on the other hand, the individual forms, notably the highly refractive eosinophile cells, are recognized with ease and their relative number noted. In most instances this percentage count was limited to the eosinophile cells, since they alone occupied attention and numerous observations, consuming much time, were necessary. As a routine the number of eosinophile cells in 300 or 400 leukocytes was determined. The character of the charts, which will be subsequently described, sufficiently vindicate the accuracy of the method and show that, even though it may not be absolutely exact, it gives an adequate presentation of the changes which the eosinophile leukocytes undergo. For comparison, I have counted by both methods specimens from five guinea-pigs and from five healthy men.

	Fresh specimen.	Hardened specimen.[1]
From guinea-pig	15.3	14.0
" "	8.7	10.2
" "	6.7	5.0
" "	1.7	3.0
" "	1.3	0.5
" healthy man	10.0	8.4
" "	3.3	3.2
" "	2.7	2.7
" "	2.0	2.6
" "	1.3	3.7

The proportion of eosinophile cells noted in the fresh specimen is not with constancy greater or less than that obtained from the hardened film. Doubtless the ordinary method of counting hardened and stained specimens is accurate only within certain limits. Thus, Boycott and Haldane,[2] making for the sake of comparison successive differential counts of 1000 cells in the same film, found in two cases the following figures for the neutrophiles in four successive thousands of white corpuscles:

59.2	55.5	55.2	53.6 %
35.8	32.7	38.7	34.8 "

For the purpose of certain experiments not included in the present paper, the guinea-pig was found more available than either the rabbit or the dog. Blood can be repeatedly obtained from the peripheral circulation by puncturing the skin of the ear or by nicking with sharp scissors the edge of the ear after clipping the hair.

[1] For assistance in counting these specimens I am indebted to Dr. Ernest Cullen.

[2] Journal of Hygiene 1903, vol. iii. p. 95.

It was soon found that the number of eosinophile leukocytes was so variable that a preliminary study of the conditions which influence them was necessary. Even though the facts concerned refer to a single species, they are, I believe, of sufficient general interest to justify a detailed study.

EOSINOPHILE CELLS OF THE BLOOD. The white corpuscles of the guinea-pig, which have been the subject of special study by Kurloff,[1] present several noteworthy peculiarities. In briefly describing the various types, I will mention characteristics observable in the freshly drawn blood. The following forms occur:

1. Polynuclear leukocytes with fine acidophile granulation constitute, Kurloff states, 40 per cent. to 50 per cent. of the total number of white cells. According to Ehrlich and Kurloff, the granulation is of the pseudoeosinophile or amphophile type, but Hirschfeld denies this statement and claims that the granules stain only with acid dyes, and, preferably, with indulin.

2. Eosinophile cells are readily recognized in fresh blood by their coarse, round, or oval, very refractive granules of somewhat greenish tint; they are very actively amœboid. In stained specimens the nucleus is often found to be horseshoe-shaped or trilobed, while all transitions between the two occur.

3. Basophile cells can be identified in the fresh specimen. They are filled with coarse, oval granules, which are easily distinguished from those of the eosinophile cell, being of greater size and only slightly refractive. These cells are actively amœboid at temperatures approximating that of the body.

4. Lymphocytes resembling those of human blood constitute, according to Kurloff, 30 per cent. to 35 per cent. of the total number of white corpuscles. Large and small mononuclear cells occur. I have frequently observed amœboid movement, but it is much less active than that of the forms previously mentioned. A short protrusion of the protoplasm occurs at one point. The projection becomes larger and knob-like, constricted where it joins the remainder of the cell. This constriction persists and passes like a wave from one side of the cell to the other as the projecting protoplasm increases at the expense of that which remains.

5. Vacuolated cells peculiar to the guinea-pig have been described by Kurloff and represent a considerable proportion of the mononuclear leukocytes. Within the protoplasm are one, or, occasionally, two globules, which, in fresh specimens, have a homogeneous, greenish color, and are more refractive than the cell protoplasm; the globule is frequently larger than the nucleus of the cell. Such vacuolated cells are inactively amœboid.

In order to obtain a basis for comparison, the occurrence of eosinophile leukocytes in the blood of normal guinea-pigs has been studied

[1] Quoted by Ehrlich and Lazarus.

and their distribution in the internal organs has been observed. Kurloff states that eosinophile cells constitute only 1 per cent. of the white corpuscles of the blood; Kanthack and Hardy give the proportion as 2 per cent. to 3 per cent. Finding these figures much exceeded in many apparently healthy animals, I have been inclined to suspect the presence of some latent pathological process. Post-mortem examination has failed to confirm this suspicion, though the possibility cannot be excluded with certainty. The intestine of the guinea-pig is subject to infection with several protozoan parasites, which apparently produce no noteworthy alteration of health. In the small intestine one not infrequently encounters the flagellate parasite, megastoma entericum, while in the cæcum infusoria are almost constantly present, often in considerable number. No relation was established between the presence of these protozoan forms and the occurrence in the blood of eosinophile leukocytes in unusually large numbers. The frequency with which eosinophile cells are found in the lungs, and notably in the wall of the bronchi, has directed especial attention to these organs. The relation of the eosinophile cells in the blood to those of the bronchi will be considered later.

Animals with high eosinophile count have been often found to be especially large, healthy specimens, and, indeed, a relation between the number of eosinophile cells and the weight of the animal is readily established. In the following table, in which the animals are ranged according to their weight, is recorded the preliminary count made upon many healthy animals previous to performing various experiments:

TABLE II.

Wt.	Eo. %	Wt.	Eo. %	Wt.	Eo. %	Wt.	Eo. %	Wt.	Eo. %	Wt.	Eo. %
299	0.6	398	0.0	481	1.3	546	16.0	667	2.3	785	19.3
287	0.0	363	0.3	436	0.3	509	0.0	615	1.5	788	15.0
		309	0.0	400	1.5	501	1.0	653	3.3	718	8.7
		385	0.3	454	0.3	556	1.3	622	4.0		
		366	1.7	423	1.3	597	29.0	649	15.3		
		345	1.7	418	0.0	567	5.7	665	9.0		
				494	0.0	586	6.7	622	36.3		
				497	0.0	578	5.7	604	10.3		
				406	0.5	532	9.7	650	7.3		
				415	0.0	588	6.8	625	24.3		
				487	5.7			672	1.5		
								697	15.0		
								641	18.0		
								604	8.8		
Mean,	0.3		0.6		1.1		8.2		11.2		14.3

In the foregoing table certain facts are noteworthy. In animals weighing less than 500 grams the proportion of eosinophile leukocytes rarely exceeds 2 per cent., and agrees approximately with that found by Kurloff and by Kanthack and Hardy; but in animals of greater weight a much higher percentage is almost constant. Even where the animal weighs more than 500 grams the proportion is

occasionally less than 2 per cent., but the mean for animals of this weight is much higher. The averages have been calculated from the figures in the various columns of the table, each of which, from left to right, represents an increase of 100 grams. After a very slight gradual increase in the proportion of eosinophile cells, reaching 1.1 per cent. for animals weighing from 400 to 500 grams, there is a sudden rise to 8.2 per cent. in the next column, followed by a more gradual increase in the columns containing guinea-pigs of greater weight. The animals, which in almost every case had been obtained from dealers only a short time before examination was made, had doubtless been subjected to varying conditions of nutrition. This fact, as will be subsequently shown, may account for some variation in the percentage of eosinophile leukocytes.

The great variation to which the number of eosinophile leukocytes in the blood of apparently healthy guinea-pigs is subject is further shown by the following table, in which in ten instances their number in one cubic millimetre of blood has been calculated from the total number of leukocytes:

TABLE III.

No.	Weight.	Leukocytes in 1 c.mm.	Eosinophiles in 1 c.mm.
1	454	8,100	24 = 0.3 %
2	521	8,700	1479 = 17.0 "
3	582	10,600	1028 = 9.7 "
4	556	16,600	249 = 1.5 "
5	578	24,200	1379 = 5.7 "
6	625	8,500	2916 = 34.3 "
7	650	12,500	913 = 7.3 "
8	690	15,700	1649 = 10.5 "
9	695	13,900	2127 = 15.3 "
10	718	10,800	940 = 8.7 "
Mean		12,960	1270 = 11 0 "

The total number of leukocytes varies within such wide limits that the proportion of eosinophile cells allows only a rough estimation of their absolute number. Nevertheless, if the figure which represents the percentage count is multiplied by 115 (the mean number of eosinophile leukocytes in one cubic millimetre of blood divided by the mean percentage count), a figure approximating the absolute number of eosinophile leukocytes is obtained. Hence the facts demonstrated by Table II. are applicable to the absolute as well as to the relative number of these cells.

EOSINOPHILE CELLS IN THE TISSUES. The distribution of eosinophile cells in the organs of the guinea-pig still further indicates that they play a very important part in metabolism. Heidenheim[1] has shown with what frequency these cells are found in the mucosa of the dog's intestine, while Teichmüller[2] has emphasized

[1] Pflüger's Arch. f. Phys., 1888, vol. xliii. Suppl. Hft.
[2] Deutsches Arch. f. klin. Med., 1898, vol. lx. p. 576.

their abundance in the lungs. Their distribution in the organs will be briefly described.

Throughout the gastrointestinal tract eosinophile cells occur in great abundance and are most numerous in that part of the mucous membrane which is between and immediately below the tubular glands. They are readily recognized in sections stained with eosin by their large, oval, brilliantly red granules. They do not differ from the eosinophile leukocytes of the blood and are provided with nuclei which are trilobed, bilobed, or horseshoe-shaped.

In the superficial part of the gastric mucosa eosinophile cells are scant, but are very numerous between the ends of the glands and in the narrow zone between the glands and the muscularis mucosæ. In the submucosa immediately below the muscularis mucosæ they are again abundant, but elsewhere in the connective tissue of the gastric wall are rarely found.

Throughout the mucous membrane of the small intestine eosinophile cells are found between the bases of the glands of Lieberkühn, in the subglandular tissue which lies between these glands and the muscularis mucosa, but are scant in the villi and in the submucosa. Such cells are especially numerous in the mucosa overlying the Peyer's patches. In the guinea-pig a diverticulum of the superficial epithelium extending downward is situated just above each constituent follicle, and in the lymphoid tissue lying between two such diverticula eosinophile cells are not infrequently so numerous that they give a red color to the tissue examined with the low power of the microscope. In the mucosa of the large intestine, and especially in the cæcum, cells with eosinophile granules are numerous between the bases of the glands.

In the walls of the trachea, the bronchi, and the subdivisions of the latter eosinophile cells are found in considerable number; in the connective tissue surrounding the bronchi and the bloodvessels similar cells occur, while not infrequently they are present in the interalveolar walls outside the capillary vessels.

Of considerable interest is the readily demonstrable fact that eosinophile cells penetrate through the epithelium into the lumen of the small bronchi. Scattered in the loose areolar tissue of the mucosa may be found cells with eosinophile granulation, and between the columnar cells of the epithelium similar eosinophile cells are easily recognized, while others have made their way into the lumen of the bronchus. Cells with scant, partially disintegrated protoplasm, containing a somewhat irregular nucleus, are usually more numerous in the same situation. The possibility that some of these nuclei represent the remains of eosinophile cells altered by the bronchial secretions has occasionally suggested itself, but the occurrence of such transformation has not been demonstrable.

Eosinophile cells are at times even more numerous in the fibrous tissue external to the muscle than in the mucosa. Should a small

nodule of lymphoid tissue occur in this situation, eosinophile cells show an especial tendency to accumulate in the part of the nodule which is next the lumen of the bronchus and in the tissue immediately overlying. Throughout the external coat of connective tissue eosinophile cells are numerous. A specimen in which eosinophile cells were particularly numerous has served to explain the origin of these cells, for in the small bloodvessels of the bronchial wall they are very numerous, probably held here by some chemotactic influence. They doubtless emigrate not only from the small veins of the connective tissue, but from the alveolar capillaries in the immediate neighborhood of the bronchus, for in these vessels they are present in much greater numbers than in the interalveolar capillaries more distant from the bronchus.

The passage of eosinophile leukocytes into the bronchi probably exerts an influence upon the number of eosinophile cells in the blood. Examination has not been made in a sufficiently large number of animals to determine the relation of the process to the eosinophilia noted in apparently normal guinea-pigs. In six of nine animals I have found eosinophile cells within the lumina of the bronchi; the weight and proportion of eosinophile cells in the blood were as follows: (1) 650 grams, 7.3 per cent.; (2) 625 grams, 24.3 per cent.; (3) 622 grams, 36.3 per cent.; (4) 604 grams, 8.3 per cent.; (5) 556 grams, 1.5 per cent.; (6) 521 grams, 17 per cent. In the three remaining animals no eosinophile leukocytes were found within the bronchi; their weight and percentage of eosinophile leukocytes were as follows: (7) 643 grams, 5.7 per cent.; (8) 454 grams, 0.3 per cent.; (9) 390 grams, 0.5 per cent.

In large, apparently healthy animals eosinophile cells migrate from the bloodvessels into the bronchi, and there is, as far as I have found, no additional evidence that the bronchi are the seat of a pathological process. The significance of this migration is not apparent.

Below epithelial surfaces other than those of the intestine and air-passages, eosinophile cells are rarely found. They do not accumulate below the squamous epithelium of the normal skin, nor of the tongue, in the mucosa of the bladder, nor in the walls of the ducts of the liver, pancreas, or testicles.

Kanthack and Hardy claim that the connective tissue is the especial habitat of the coarsely granular oxyphile cell, yet only in certain localities are they constantly present in considerable number. Cells with eosinophile granulation are infrequently observed in the subcutaneous areolar tissue, in the fascia and septa of muscles, and in the connective tissue of the liver, kidneys, adrenal glands, pancreas, thyroid, and testicles. In the serous membranes, the omentum and the mesentery, on the contrary, eosinophile cells are fairly numerous and are distributed in greatest number along the course of the small bloodvessels. Within the serous cavities, as Kanthack and Hardy

have shown, these cells are constantly present and constitute from 30 per cent. to 50 per cent. of the total number of cells in the peritoneal fluid of the normal guinea-pig.

Little attention has been paid to the intimate relation which exists between the lymphatic apparatus and the eosinophile cells. Their abundance in the lymphoid tissue of the gastrointestinal mucosa has already been noted and attention has been directed to their accumulation in the Peyer's patches of the small intestine and in the lymphoid follicles of the bronchi. Their presence in the serous cavities is noteworthy. They are, moreover, constantly present in the lymphatic glands, not only in those at the base of the mesentery, but in the peripheral glands, such as those in the inguinal region as well. Eosinophile cells are not found within the follicles which occupy the cortex of the gland, but are fairly abundant at the periphery of the follicles, near and at times within the peripheral sinus. Within the sinuses of the medulla eosinophile cells occur in small numbers, but in the medullary cords they are more numerous and are not infrequently ranged along the margins of the sinuses.

In the connective tissue in the immediate periphery of the lymphatic glands eosinophile cells are often found in abundance, and their number diminishes as the distance from the gland increases. In one specimen, by a fortunate accident, I obtained evidence that these cells are derived not from the gland, but directly from the blood. Cells with eosinophile granulation were here numerous, both in the tissue and in the small veins, and had been actually fixed in process of migration from the latter. In several instances elongated eosinophile leukocytes had partially penetrated the endothelium of the vessel, part still remaining within the lumen.

In the bone-marrow cells, with coarse eosinophile granulation, are more numerous than in any other organ of the healthy animal. Here alone are found the large mononuclear eosinophile cells described by H. F. Müller and Rieder.[1] They are analogous to the myelocytes of Ehrlich, which are essentially cells of the bone-marrow and only in leukæmia find their way into the general circulation. The myelocyte with eosinophile granulation is considerably larger than the eosinophile leukocyte, and is provided with a large round or oval, often irregularly indented nucleus. In sections of marrow hardened in Zenker's fluid the nuclear membrane stains deeply with hæmatoxylin, giving a vesicular appearance to the nucleus, but chromatic substance is not abundant, so that the nucleus, particularly in dried preparations, stains palely. Müller and Rieder have shown that these cells are capable of little if any amœboid movement.

In addition to myelocytes with eosinophile granulation, smaller eosinophile cells with polymorphous nuclei are present in the bone-marrow. Many of these are identical with the eosinophile

[1] Deutsches Arch. f. klin. Med., 1891, vol. xlviii. p. 47.

leukocytes of the blood and are capable of amœboid movement. Cells of the same size may contain a rounded nucleus, which is usually kidney-shaped as the result of an indentation at one point. Other small eosinophile cells have a nucleus which has the form of a bent rod; constrictions at intervals so divide the rod that it is transformed into the lobed nucleus which is found in the eosinophile leukocytes of the circulating blood.

Mitotic division of eosinophile cells in mammals was first described by H. F. Müller,[1] though similar observations had been made by Flemming[2] and Dekhuysen[3] in amphibia and birds. Such division in the guinea-pig takes place only in the bone-marrow and occurs in cells which are usually so large that they are recognized as myelocytes.

Corresponding to the varying number of eosinophile cells in the circulating blood of guinea-pigs, the bone-marrow exhibits variations which help to explain the origin of these cells. In animals of which the blood during life contains approximately 1 per cent. of eosinophile leukocytes fat is very abundant and the cells of the marrow occupy the interstices between the fat-cells. Eosinophile cells of the characters already described occur in moderate numbers scattered among the other cellular elements. In animals with a larger proportion of eosinophile cells in the blood, similar cells are more numerous in the marrow, but in guinea-pigs in which the eosinophile cells of the blood reach the proportion of from 15 per cent. to 30 per cent. the bone-marrow presents a characteristic appearance. The fat is in great part or wholly replaced by myeloid tissue, which is largely composed of cells with eosinophile granules. Myelocytes are particularly numerous, but smaller cells with polymorphous nucleus are not wanting. Eosinophile cells in process of mitotic division are readily recognized by the hyperchromatic condition of the nucleus, and never in large numbers, are much more numerous than usual; the so-called diaster stage of mitosis is not infrequent.

In the pulp of the spleen eosinophile cells are found in considerable number, and are more abundant the greater the number in the circulating blood. They are absent within the Malpighian corpuscles, but are particularly abundant in the pulp at their periphery. Eosinophile myelocytes do not occur and mitotic figures are not demonstrable.

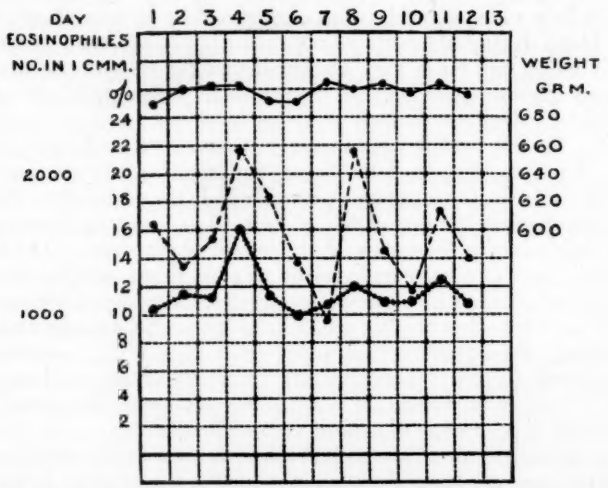
Relation of the Eosinophile Cells to Nutrition. In apparently healthy guinea-pigs weighing more than 500 grams, eosinophile leukocytes, as it has been shown, not infrequently form from 15 per cent. to 30 per cent. of the total number of leukocytes, and in the greater number of instances constitute 8 per cent. to 14 per cent. In this animal, more readily than in man, where the eosinophile cells rarely exceed 4 per cent., it is possible to deter-

[1] Arch f. exper. Path. u. Phar., 1892, vol. xxix. p. 221.
[2] Arch. f. mik. Anat., 1891, vol. xxxvii. p. 249.
[3] Anat. Anz., vol. vi. p. 220.

mine the conditions with which these cells are diminished, as well as those with which they are increased.

It was considered desirable to make a preliminary study of the changes to which the eosinophile leukocytes may be subject under ordinary conditions. For this purpose the blood of guinea-pigs supplied with abundant food and water were examined repeatedly for a considerable period of time, and variations in the number of eosinophile cells were noted. The animals were allowed to feed at will and no allowance was made for a possible leukocytosis of digestion. The records which follow indicate that such leukocytosis is not an important disturbing factor. The weight of the animal serves as the best indication of its condition and has been recorded in conjunction with the count of eosinophiles.

CHART 1.



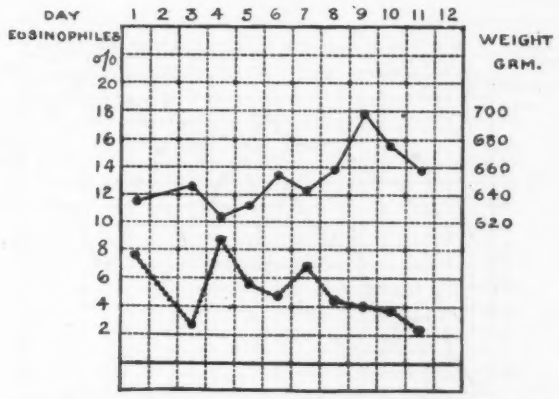
In this and in the charts to follow the percentage of eosinophile cells is represented by a dotted line, their number in one cubic millimetre of blood by a broken line. The weight of the animal is represented by a black line.

In Chart 1 are recorded the weight of the animal, the proportion of eosinophile cells in the blood, and their absolute number in one cubic millimetre of blood, calculated from the total number of leukocytes, which have been estimated daily by means of a Thoma-Zeiss apparatus. During twelve days the weight has varied little, ranging from 690 to 705 grams. The proportion of eosinophile cells exhibits slight variations, which correspond fairly well to much more marked alterations of their absolute number. At intervals of several days there is a recurring increase in the number of these cells, as though

many were rapidly thrown into the circulation. The sudden elevation of the curve is followed by a somewhat more gradual fall.

In Chart 2 only the weight and proportion of eosinophile cells are recorded.

CHART 2.



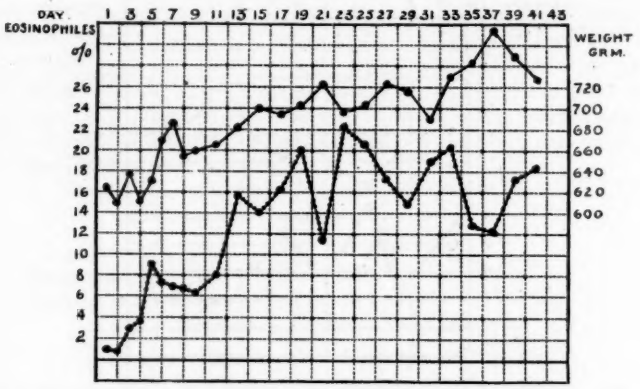
The weight of the animal varies within wider limits than that recorded in Chart 1, and, as in the previous instance, the proportion of eosinophile cells alternately increases and decreases. A comparison of the two curves suggests that the number of eosinophile cells bears a relation to changes in the weight of the animals, for repeatedly an increase in weight is accompanied by a fall in the proportion of eosinophiles, while a decrease of weight is accompanied by an increase in the number of these cells, so that the two curves tend to vary in opposite directions. This phenomenon is not constant, for on the tenth and eleventh days, though the weight has fallen, the eosinophiles do not rise. Doubtless, conditions other than those which affect nutrition exert an influence on the proportion of eosinophile cells, and in Chart 1, though the number of eosinophile leukocytes varied considerably, the weight changed little.

A relation between variations in weight and proportion of eosinophile cells is even better indicated in the following curve, where the eosinophile leukocytes rose gradually during a period of nearly three weeks. Alterations of the number of eosinophile cells, with much constancy, take an opposite direction from those of weight, and at times these contrary variations extend over a period greater than a week.

There was reason to suspect that the animal of which the number of eosinophile cells is recorded in Chart 3 had received, just before these observations were begun, an insufficient amount of food. The possibility has suggested itself that the food supply may exert an influence upon the eosinophile leukocytes of the blood.

By the use of Ehrlich's triple stain somewhat modified Heidenhain demonstrated the existence of cells with deep-red granules, undoubtedly eosinophile cells, in the villi, and still more abundantly in the subglandular layer of the dog's intestinal mucosa, and studied

CHART 3.



these cells under varying conditions of nutrition. If animals were starved during from four to seven days and then killed, eosinophiles disappeared from the villi and their number in the subglandular layer was diminished. Considerable variation was noted in individual cases, and in one instance eosinophile cells were numerous even after some days without food. Abundant feeding produced the opposite condition; if a dog receiving an ordinary diet was given a large meal of meat and was killed fourteen to sixteen hours later eosinophile cells were found in very large numbers, both in the villi and in the subglandular layer. Sugar in large amount had the same effect as proteid diet. Continued overfeeding diminished rather than increased the number of cells with eosinophile granulation.

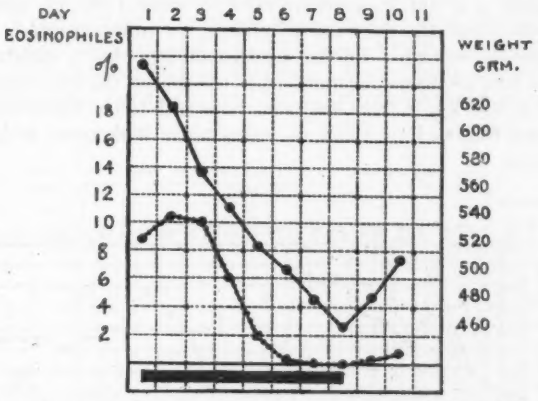
Teichmüller repeated with guinea-pigs some of the experiments of Heidenhain. He found that starvation causes the number of eosinophile cells in the intestinal mucosa to diminish, but thought that the number in the spleen was increased. If, however, the animal was killed by starvation, eosinophiles were diminished in the intestine, spleen, and bone-marrow. Hence, he reached the conclusion that starvation causes a temporary increase of eosinophile cells, followed by diminution of their number.

As far as I have been able to determine, observations upon the eosinophile cells of the blood during starvation have been made only by Tanszk,[1] who observed the fasting juggler Succi. An increase in the proportion of eosinophile leukocytes was noted.

[1] Wiener klin. Rundschau, 1896, No. 18. Quoted by Teichmüller.

Following the suggestion offered by Chart 3, I have studied the effect which withdrawal of food exerts upon the eosinophile leukocytes of the circulating blood. The consequent changes are well shown in the following chart.

CHART 4.



In this and in the charts to follow the period during which the animal received no food is indicated by a broad black line at the bottom of the chart.

Though the weight diminished continuously from the beginning of the experiment, there was a primary increase in the proportion of eosinophile leukocytes, but after the third day they also decreased in number, and on the seventh and eighth days none were found in the specimens of blood which were examined. Estimation of the total number of leukocytes in conjunction with the proportion of eosinophile cells in two animals from which food was withheld has shown that diminution of the absolute number of eosinophile cells is accurately represented by the preceding chart, which records only their relative number.

GUINEA-PIG A.

Day.	Weight, grm.	Leukocytes in 1 c.mm.	Eosinophiles in 1 c.mm.
1st	712	11,900	1428 = 12.0 %
2d	677	8,600	1075 = 12.5 "
3d	645	14,200	2087 = 14.7 "
4th	619	10,600	1325 = 12.5 "
5th	594	15,500	852 = 5.5 "

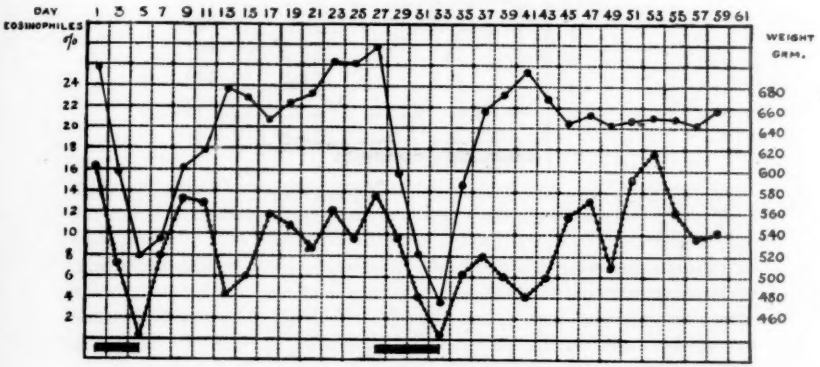
GUINEA-PIG B.

1st	650	7,900	869 = 11.0 "
2d	615	12,900	1741 = 13.5 "
3d	579	12,000	840 = 7.0 "
4th	550	17,500	787 = 4.5 "
5th	526	10,900	414 = 3.8 "

In both experiments an increase in the relative and in the absolute number of eosinophile leukocytes preceded the fall, which began on the fourth day of starvation.

If food is withheld during several days, the animal may loose in weight 100 or more grams, and, gradually recovering, regain its former size only after several weeks. With the administration of food there is a sudden increase both of weight and of eosinophile leukocytes, but the increase of neither is uninterrupted. In the experiments recorded by the accompanying chart, withdrawal of food on two occasions, namely, from the first to the fifth days of observation, and again from the twenty-seventh to the thirty-third day, has been followed by a fall of eosinophile leukocytes to less than 1 per cent.

CHART 5.



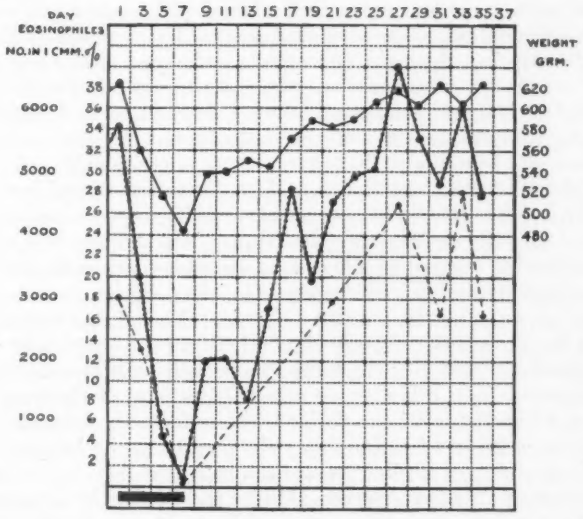
During the period which follows the administration of food the chart exhibits the phenomenon which has been noted in the normal animal. Increase in the proportion of eosinophile leukocytes is not continuous, and after two or three days their number falls, even though the weight, which is yet far from normal, continues to rise. Soon the increase of weight is interrupted, and with a fall in the curve of weight there is an increase in the proportion of eosinophile cells. This phenomenon is conspicuous during the first ten days or two weeks after starvation, but may be subsequently absent.

In the experiment recorded in Chart 6, an animal was employed of which the blood contained eosinophiles in the unusual proportion of 34 per cent.; the total number of leukocytes was, however, somewhat less than usual.

In this experiment the eosinophile leukocytes did not fall to 1 per cent. until the seventh day after food had been withdrawn; the weight diminished during this time 140 grams. The subsequent rise and fall of the curves representing weight and eosinophile cells

show the remarkable relation previously observed, though the falls in weight on the nineteenth and again on the twenty-fifth day, with which in each case corresponds a sudden rise in the proportion of eosinophile cells, are so slight that they may be regarded as interruptions of the gradual return to normal. The total number of leukocytes was estimated at intervals, in order to determine the absolute number of eosinophile cells in one cubic millimetre of blood, but no important difference between the proportion and the absolute number of eosinophile leukocytes was observed. Particularly noteworthy is the fact that variations affecting the proportion of eosinophiles, and

CHART 6.



occurring between the thirty-first and thirty-ninth days, when the animal's weight had become normal, correspond to inverse variations of weight, and represent the absolute as well as the relative number of eosinophile cells.

In three animals I have studied in sections from tissues hardened in Zenker's fluid the effect of starvation upon the distribution of the eosinophile cells. The weight, the percentage of eosinophile leukocytes at the beginning of the experiment, and the date of death were as follows:

No. 1.	Weight,	385	grm.	Percentage of eosinophiles,			0.3.	Killed on the		5th	day.
" 2.	"	712	"	"	"	"	12.0.	"	"	6th	"
" 3.	"	650	"	"	"	"	11.0.	"	"	8th	"

Except in the animal killed on the eighth day of starvation, there was no noteworthy diminution in the number of cells with eosinophile

altered that they stain readily with eosin, while Mesnil maintains that anthrax bacilli are transformed into eosinophile granules by leukocytes of the lizard.

SUMMARY AND CONCLUSIONS. The opinions which have just been cited will not be discussed in detail. I will merely review certain facts which I believe serve to explain the origin of the eosinophile cells. In various tissues of the guinea-pig, notably in the mucosa of the gastrointestinal tract, in the mucosa of the air-passages, in the lymphatic tissue, and in the spleen, occur eosinophile leukocytes which are identical with those present in the circulating blood, and, like them, are provided with polymorphous nuclei. In the bone-marrow alone occur large mononuclear cells with eosinophile granulation. These cells of the bone-marrow undergo mitotic division and form daughter cells, which resemble in size the eosinophile leukocytes of the blood, while cells in which the nucleus presents varying irregularity in shape may be regarded as transitional forms. In the blood and in various organs the eosinophile cells give no evidence of multiplication.

The myelocytes with neutrophile or amphophile granules are analogous to the myelocytes with eosinophile granulation, resembling them in size and in the character of their nuclei. Muir[1] found that when the amphophile leukocytes in the blood of the rabbit undergo continued increase as the result of repeated bacterial infection, the myelocytes of the marrow are increased in number and mitotic division proceeds actively. An analogous phenomenon has been noted in those guinea-pigs of which the circulating blood contains a very large proportion of eosinophile leukocytes. The number of eosinophile cells is far greater than usual, while particularly abundant are the large eosinophile myelocytes. Mitotic division of these cells is observed much more readily than in the marrow of animals in which the blood contains few eosinophile leukocytes.

In certain instances in which eosinophile cells have accumulated in the tissues it has been possible to demonstrate their abundance in the bloodvessels of the part, and in one case the process of migration was actually demonstrable in sections of the hardened tissue. In apparently healthy guinea-pigs eosinophile leukocytes have been shown to migrate from the bloodvessels into the wall of a small bronchus, and hence through the epithelium into the lumen. Eosinophile cells manufactured in the bone-marrow reach the tissues by way of the bloodvessels.

The number of eosinophile cells in one cubic millimetre of blood is found to vary from day to day, and at intervals of three or four days undergoes an increase. It is not improbable that the number of eosinophile cells which the bone-marrow discharges into the circulation is subject to periodic variation. Complete withdrawal

[1] Journal of Pathology and Bacteriology, 1903, vol. viii. p. 101.

of food is followed by a decrease both in the proportion and in the absolute number of eosinophile leukocytes in the peripheral circulation. Disturbance of nutrition acting doubtless on the bone-marrow affects the multiplication of the eosinophile cells more readily than that of the polynuclear leukocytes with fine granulation. Diminution in the number of eosinophile cells is preceded by a temporary increase, which may be explained by supposing that ripe eosinophile leukocytes already stored in the marrow reach the circulation, and, perhaps, are no longer diverted to the intestinal mucosa. With the administration of food the eosinophile cells of the blood gradually increase in number, but neither the weight of the animal nor the eosinophile leukocytes increase continuously. That there exists a close relation between the nutrition of the animal and the eosinophile cells is shown by the fact that variations in weight and in the number of eosinophile cells take with much regularity opposite directions, so that a temporary fall in weight is accompanied by a rapid increase of the eosinophile leukocytes, while a rise in weight tends to retard this increase.

CIRCUMCORNEAL HYPERTROPHY (VERNAL CONJUNCTIVITIS) IN THE NEGRO.

By Swan M. Burnett, M.D., Ph.D.,
of Washington, D. C.

It would seem from a report of the discussion of a most carefully prepared paper on "Vernal Conjunctivitis," read by Dr. W. C. Posey[1] at the last meeting of the American Medical Association, at New Orleans, that opinion is far from being settled as to the peculiar manifestations of this singular affection in the negro in this country. As some statements of mine in a paper published in Knapp's *Archives* in 1881, in which the phases of the disease as it appears in the negro were first brought to the attention of the profession, have apparently not been clearly understood or not confirmed by other observers, it may not be without interest to revert to the subject again in an endeavor to harmonise views and clarify some seeming obscurities.

It appears to be a question with some whether the appearances described in that paper, and also in my chapter on "Diseases of the Conjunctiva" in Norris and Oliver's *System*, are not those of phlyctenular conjunctivitis, instead of that distinct form of disease now generally denominated as "spring catarrh" of the conjunctiva.

A rather extensive study of the disease (principally by Europeans) since Sämisch first reported upon it in 1876 has not added greatly to

[1] Published in Journal of the American Medical Association, July 15, 1893.

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A rather extensive study of the disease (principally by Europeans) since Sämisch first reported upon it in 1876 has not added greatly to

[1] Published in Journal of the American Medical Association, July 25, 1903.

our very limited knowledge of the cause and pathology of the affection. The clinical characteristics of that feature of the disease manifest on the globe are so distinctive that it seems quite impossible that anyone who has once seen a pronounced case could be mistaken in the diagnosis, so utterly unlike any other known condition is it. The above-mentioned opinion of some well-known and accurate observers that it may be a form of phlyctenular disease leads me to think that they have never seen a typical case of circumcorneal hypertrophy; from which we may infer that the affection is much more frequent in some sections than in others, a fact that may be found of no small etiological importance, and give a clue which should be assiduously followed up. Those of us whose work lies in localities where the negro abounds are well aware of the great frequency of scrofulous or strumous affections of the cornea and conjunctiva in that race, and can confirm Dr. Bruns' statement as to its frequent cause of blindness and greatly impaired vision. But there is no manifestation of this diathesis, either on the cornea or conjunctiva, which at any stage bears any resemblance to the ocular form of circumcorneal hypertrophy as found in the negro. The clinical features of scrofulous conjunctivitis are marked by certain constant and well-recognized characteristics. When it appears under the distinctly phlyctenular form the elevations are discrete, though they may be several in number. Whether the inflammatory symptoms are slight or severe, the natural history of the phlyctenula is the same; its wall bursts, its contents are discharged, and an ulcer results, which heals, as we know, with a very greatly varying rapidity. Photophobia and lacrymation are rarely absent, and may be present in the intensest degree. When the manifestation is on the cornea itself the exudate is still more or less circumscribed and small, with a very variable amount of destruction of tissue and cicatricial formation as a result. On the other hand, the distinguishing mark of circumcorneal hypertrophy is that it is *not destructive*. It is a true hyperplasia, and it was with a view of making this essential feature prominent and descriptive in nomenclature that I adopted the name "circumcorneal hypertrophy" as the best English synonym of the "hypertrophie perikeratique" of Desmarnes and the "gallertige Verdickung des Limbus" of Gräfe. This hyperplasic character of the pathological condition has been confirmed by all examinations of the tissue that have been made. Scheile has shown that the principal change in the circumcorneal form is in the epithelial layer, manifested by a largely increased number of the cells with invaginations, constituting the so-called "cancroid formations," together with some increase in the connective tissue. A drawing representing these appearances is given in my chapter on "Diseases of the Conjunctiva" in Norris and Oliver's *System*. Some more recent investigations made by de Schweinitz and Shumway, and published in the *University of Pennsylvania Medical Bulletin* for June, 1903, reveal

identical changes in the conjunctiva of the lid. Everywhere there is hypertrophy and nowhere a destruction of tissue.

There has not been a season since the publication of my paper in 1881 in which I have not observed cases of this disease—sometimes in considerable numbers—and not once have I observed any tendency toward destructive ulceration. If there is a destructive process, it is not circumcorneal hypertrophy. On the subsidence of the hypertrophy during the winter there seldom remains any sign of its former presence.

There are cases in which the symptoms of irritation are considerable. In the bulbar form, when the conjunctiva of the lid is but little involved, these symptoms are confined to a slight hyperæmia of the conjunctiva of the ball, but more often there is no complaint of photophobia or lacrymation. In the palpebral form, especially where there are large hard excrescences which rub on the cornea, the irritation may be quite marked, as indicated by a congested state of the conjunctiva of the globe and some photophobia. There is, however, never an involvement of the cornea aside from the hypertrophy. The usual, and, indeed, the characteristic complaint is not of pain, but of an intense itching of the eyes and sometimes of a "burning sensation," quite distinct from the subjective symptoms of phlyctenulæ.

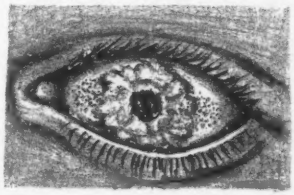
It is the objective appearance, however, which is so strikingly distinctive, especially in the bulbar form. The dirty gray elevations at the base of the cornea bear no resemblance whatever, when they are at all marked, to any other pathological condition found there. It must be remembered in this connection that the circumcorneal epithelial changes vary enormously in degree. Sometimes they are so slight as to escape detection unless carefully sought for. It may be that there is manifest only a macerated condition of the cells, with some slight increase in number, and confined to a very limited portion of the corneal circumference. Even in pronounced cases the hypertrophy may not go entirely around the cornea. I believe that in every case, even where the changes are supposed to be limited to the conjunctiva of the lid, a careful examination will reveal some changes at the limbus. I have one such case, in a negro girl, aged nine years, under observation at my clinic now, in which the palpebral changes in the form of granulations are typical, but the circumcorneal alterations could easily be overlooked if particular care were not given to finding them. This child has been subject to the disease since she was three years old, the symptoms beginning in March and continuing until October. In her the rubbing of the cornea by the granulations gives rise to some lacrymation, but the irritative symptoms are slight.

At other times the alterations around the cornea are so striking that when seen fully blown, for the first time in the negro, they are likely to confound even an experienced diagnostician in eye diseases.

I remember such an experience with one of my associates in a hospital in this city. He was a man trained to careful observation, and had followed some large eye clinics in a neighboring city in the South, where the clientèle of negroes was large. He asked me to see a case of peculiar corneal disease, the exact nature of which he was unable to determine. As soon as the patient, a negro boy, aged eight years, entered the door of the clinic room I turned and asked him if he had ever seen such a condition before, recognizing, as I did, even at that distance, what the disease was. He was greatly surprised to find that it was a typical case of circumcorneal hypertrophy in the negro, a condition with which he was entirely unfamiliar, though he had seen the disease in the white race. Thereafter there was never any difficulty in his diagnostication of even slight forms of that disease, for it is a fact that one familiar with its appearances in the negro can easily make the diagnosis across the room. There is an aspect of the eyes, due to the peculiar appearance of the palpebral aperture, which, once seen, cannot be taken for anything else. The "white" of the eye in the negro, especially in the young, is very clearly marked, often brilliant, in contrast with the surrounding dark skin. In circumcorneal hypertrophy this is changed. The palpebral aperture has a dull, soggy look, and a dusky appearance, as though it had been smoked. This "smoked" look is not always of the same intensity, but even in mild cases is sufficiently pronounced to be recognized at a distance of many feet. In no other affection of the eyes in the negro have I encountered this singular look of the palpebral aperture. A closer examination shows the cause of this "smoked" appearance to be a pigmentation of the conjunctiva, which is more or less thickened and easily thrown into folds with the movements of the ball inward or outward. The epithelium has some of that lack-lustre look which is seen in a greater degree in xerosis of the conjunctiva. The smoky look is confined almost entirely to the space exposed by the palpebral fissure. The parts usually covered by the lids are not affected. The pigment is usually in very small, dot-like points, to be differentiated only under a magnifier, but toward the base of the cornea it may be in quite large masses, some of which measure a quarter of a millimetre in diameter. This smoky look of the palpebral aperture disappears with the subsidence of the disease during the colder months, when the eyes return to approximately their normal appearance; not always, however, for there are occasional cases which continue, with all the characteristic appearances, during the winter months, though commonly with diminished intensity. The statistics at my clinic and also, I learn, from my confrères, at the other eye clinics in Washington, show that the negro in this section is much more prone to the disease than the white race. At my clinic it is rare to see a case among the white patients. Of thirteen cases of the disease recorded during the last eighteen months all were colored.

Opinions differ as to the relative frequency of the bulbar and palpebral forms. My own belief is that they both exist together, but one may be so slight as to escape detection unless carefully looked for. I also think that the same patient may have one or the other form more pronounced at different seasons.

A typical but extremely pronounced case of the disease in the negro is shown in the accompanying drawing. The patient was a negro boy, not perhaps of full blood, but quite dark, who at the time the drawing was made (1899) was sixteen years old. The dull, "greasy," gray hypertrophy, which was elevated 0.5 mm. to 1 mm. above the surrounding tissue, was irregular as to surface, and not only occupied the conjunctival tissues in the vicinity of the cornea, but invaded the corneal surface so far as to leave less than one-half of the iris exposed to view. Both the internal and external edges of the elevation were irregular in outline. The cornea inside the inner border was perfectly clear and the vision was not materially affected. The conjunctiva visible within the palpebral fissure was dark brownish in tinge, and there were many points of pigment in the vicinity of the elevation arranged, as they usually are, in the form of triangles, with their apices toward the canthi. The conjunctiva of the lids presented an appearance quite different from that usually seen in such cases, in so far as there was not that distinctly granular aspect which is commonly regarded as characteristic. The tissue was much thickened and lined with many furrows, undoubtedly an exaggeration of the same pathological changes that produce the excrescences—namely, a large proliferation of the epithelial structure. Both eyes were affected and practically to the same extent. The final issue of the case, which I followed for several years, I am not able to give, as the patient disappeared from view soon after the drawing was made.



That the disease is the manifestation of a dyscrasia seems certain, but it is not so certain what that dyscrasia is. Of course, we can never exclude what we call scrofula in any patient of the colored race, and yet there is nothing about the appearance of the condition itself or in the patients which would justify the acceptance of any such stigma as a cause. It occurs often in the most robust-looking, with none of the usual signs of deficient nutrition. I have looked in vain for some connection of inherited syphilis with the disease. In my experience the male and female sexes are about equally represented; and while principally an affection of childhood, the adult is by no means free. I have seen one pronounced case in a mulatto woman aged thirty years. Both eyes are

affected, but not always at the same time nor in the same degree. As is well known, the disease is most prevalent during the hot months, and so far as a seasonal nomenclature is applicable, "summer conjunctivitis" would be the more nearly appropriate. Strictly speaking, however, the affection is not a conjunctivitis at all, taking conjunctivitis to mean an inflammation of the conjunctiva. It is not only not confined to the conjunctival tissue proper, but there are none of the clinical characteristics of conjunctival inflammation, there being seldom any increase in the conjunctival secretion, either mucous or purulent. The term "catarrh" may be accepted in the conventional meaning of that term as applicable to all alterations in the mucous tissues.

The possible relation of the disease to trachoma has naturally attracted attention, since the granular condition of the lids suggests in some instances the appearances in trachoma. The similarity, however, is only superficial, for the essential nature of the two conditions is diametrically opposite. In trachoma the action is destructive, whereas in this disease it is purely hyperplastic, and when the affection subsides for the winter the conjunctiva assumes an almost if not quite normal appearance. There is an observation in this connection, however, which is not only interesting in itself, but may prove of value in making our final judgment as to the pathology of the disease, which should be noted, and this is the almost total absence of circumcorneal hypertrophy in Russia, where trachoma is so rampant. According to Natanson,[1] the "flying column" of 100 oculists, which was sent throughout the provinces of Russia from 1893 to 1897 to look after diseases of the eye among the peasantry, did not meet among 168,618 patients, a large percentage of whom were trachomatous, with a single case of vernal conjunctivitis. Of course, it may be said that only the severely affected applied for treatment, and, circumcorneal hypertrophy being a practically painless disease, the stoical peasants paid no attention to it. But the reports from the clinics at St. Petersburg, Moscow, Kiew, and other Russian cities show the same practical immunity of the Russian from this affection.

This fact, taken in connection with the other fact that the negro in this country is practically immune from trachoma and is very liable to circumcorneal hypertrophy, offers a suggestion as to an antagonistic character in the diseases which, if followed up, might lead to some more definite knowledge of both affections. It would be instructive to know how such countries as Ireland and Southern Italy, as well as other localities where trachoma prevails, stand as to the percentage of circumcorneal hypertrophy. At any rate, these facts, as well as others, point most strongly to a racial influence, and a dyscrasic nature for both affections. Temperature, humidity, and

[1] Klin. Monatsbl. f. Augenheilk., April, 1900.

elevation do not seem to be controlling factors to any great degree according to Natanson.

In regard to therapeutics, the indications, in view of what we know of the pathology, are for palliative local measures. Operative procedures, such as excision of the masses, expression, etc., have been recommended and practised, but evidently are not advisable. Attention to the nutrition and an improvement in the general condition are more properly called for. Arsenic administered in some form meets with the approval of most of those who have written upon the subject.

A CASE OF SEBORRHŒA NIGRICANS (BLACK MASK OF THE FACE).

By Arthur Van Harlingen, M.D.,
of Philadelphia.

I am obliged to my friend Dr. J. S. Bethune, of Baddeck, C. B., for the opportunity of seeing this extraordinary affection of the skin and also for some notes of the history of the case.

Maggie McL., aged twenty-three years, comes of a neurotic family. Some members of the family are said to have suffered from mental alienation, and her father is a man of marked peculiarity of temper and disposition. Until her nineteenth year the patient enjoyed fair average health. She was brought up in the salubrious atmosphere of Cape Breton, but had lived out as a domestic, in Boston, I think, for a short time.

At this age she began to fail in health, although an exact statement of the symptoms could not be obtained. She was obliged to relinquish domestic service, returned home, took to her bed, and had remained there for four years up to the time of my examination. This scanty history was all that I could get of the patient's previous condition. It was, however, stated that soon after she took to bed a discoloration began to appear upon the face, which gradually spread and grew deeper in color until the entire visage was covered with a thick black mask.

Within the past few months the area of discoloration diminished until it had shrunken to the dimensions about to be noted. When I first saw her the patient was lying in bed in a small one-room cottage within a few feet of the cook-stove. She had been bedridden for several years, but, although somewhat emaciated, did not seem particularly ill. The limbs could be moved without much difficulty, though each movement and even a touch excited complaints of pain. She usually lay with her eyes shut, the lids twitching, and

seemed to be suffering from photophobia. The face was flushed and mottled, the skin dry and scaly. The lips were dry and the skin immediately circumjacent covered with a yellowish sordes or crust, vesicular or seborrhœic in character, which surrounded the whole mouth. Her tongue was parched, red, and slightly fissured. It was said that this eruption about the mouth was accustomed to run a course of several weeks, turning black and falling off, to be succeeded by a fresh outbreak. The forehead and nose were covered with a most extraordinary mask or crust more than a quarter of an inch thick, resembling a rind of ham—soft, greasy, sharply defined about the edges, and rounded. It could be easily broken off, and the forceps could be thrust into it at any point as if the crust were comprised of soft fat. The color of the crust was exteriorly of an inky blackness and tolerably smooth. The appearance of the face was as if a mask or vizard were worn over the upper part.

The patient's general condition was that of an hysterical person. The shrinking from light, the groans and complaints on the slightest attempt at moving her, or even touching any part of the body, were highly characteristic. Trials at various points of the surface with a sharp object failed to disclose any areas of insensibility; in fact, the tactile sense appeared normal. Exception should be made of the scalp, which was certainly hyperæsthetic.

She had complained for some weeks of extreme sore throat, but seemed able to swallow without much difficulty. It was said she had taken nothing in the way of food for some weeks, but only an occasional drink of water. Her comparative lack of emaciation and the fact that the evacuations by the bladder and rectum were regular seemed to militate against the accuracy of this statement.

The attendants were supplied with a solution of sapo viridis in water and directed to endeavor to loosen the mask by daily washings. At the end of a week, however, when I saw her for the second time, the mask had not been at all cleaned off. It was loosened, however, and I had no difficulty in stripping off the entire coating. It came away like a thick crust of fat, tearing here and there, where undue traction was made. The outer surface was smooth, rather dry, and black, with bits of wool, hair, etc., matted in it. The internal surface was of a whitish color, soft and very greasy, showing numerous conical elevations, corresponding to the openings of the glands. The skin underneath was washed clean of the mask-coating, and then

appeared moist and oily, the epidermis rather sodden and in places slightly abraded. The process of removal was in no way painful. The parts affected were ordered to be washed daily with a watery solution of green soap and powdered with a mixture of aristol and boric acid. A week after this I saw the patient again for the last time. The skin of the face was dry, red, and slightly scaly, the powder having dried it off. The washing having been very imperfectly performed, some greasy patches were still left of the mask. Also along one side of the nose there was a greenish crust, evidently seborrhœic in character. The skin being abnormally dry, it was decided that while continuing the daily washing with soap and water a dilute oxide of zinc ointment should also be employed. I preserved a portion of the greasy mask-like crust, which dried up gradually and shrunk, but retained a most offensive odor. Treated with ether a portion of the crust separated into various and heterogeneous components; there were fragments of wool and hair, granular débris, probably dust and grime, and whitish soft bits of tissue, which, picked out, treated with a solution of caustic potash and glycerin and examined under the microscope, were found to be composed of epithelial scales, with fine granular oil globules. The epithelial scales seemed dry and were not in a state of fatty degeneration. There were some few lanugo hairs.

The conclusion reached was that we had to deal in this case with a severe case of oily seborrhœa, giving rise to a dusky secretion upon the surface, which had been allowed to accumulate for several years, and which had, perhaps, been added to by the inunction or application of ointments and dressings of various kinds, together with accretions from the surrounding apartment, dust, flakes of soot, the sweepings of the carpet, etc. Most patients suffering from such affections are cleansed more or less frequently, and it is only by long-continued neglect that such extraordinary results are reached.

We have become familiar of late years with that form of chromidrosis which occurs in a black circle about the orbit or in rarer cases upon the forehead of certain hysterical women. In these cases the oily secretion from the coil glands is changed in color and consistency, and forms the discolored crust. In some cases, however, the sebaceous glands play the most prominent part, and such, I think has occurred in the case reported. As I believe this to be unique, I have not given any reference to the cases of chromidrosis recorded. A complete account of the latter affection is given in my article in the *Twentieth Century Practice of Medicine*, vol. v. p. 539, where the symptoms are fully described.[1]

[1] Since these notes were written I have received a letter from Dr. Bethune. He says: "The patient complains of a great deal of pain all over the face and head. The skin in patches over the face looks very red. She says it burns. This very likely is caused by the too frequent use of the sapo viridis, so I ordered it used less frequently. There is no sign of the mask, nor is there any sebaceous matter about the sides of the ala nasi. Her general condition is about the same as when you saw her (three months ago)."

A REPORT OF TWO CASES OF ECTOPIC GESTATION AND A CASE OF INTESTINAL OBSTRUCTION DUE TO MECKEL'S DIVERTICULUM.

By Harold H. Heyer, M.D.,
and
H. M. Lee, M.D.,
of New London, Conn.

Case I.—Mrs. X., white, American, aged twenty-six years; married in June, 1902. Housewife by occupation, presented herself at the office of my colleague, Dr. Heyer, on May 6, 1903, complaining of what she considered a prolonged menstrual period, and also of some slight pain and tenderness in the lower abdominal region

Family History. Negative.

Personal History. Had never had any illness she could remember except an attack of peritonitis (so-called) when eleven years of age.

Menstrual History. Commenced menstruation at the age of twelve years, and except on a few occasions had menstruated regularly. The average duration of her periods was five days—menstruating at an interval of twenty-eight days.

Since marriage her menstrual periods have appeared with regularity and without pain. She had never been pregnant.

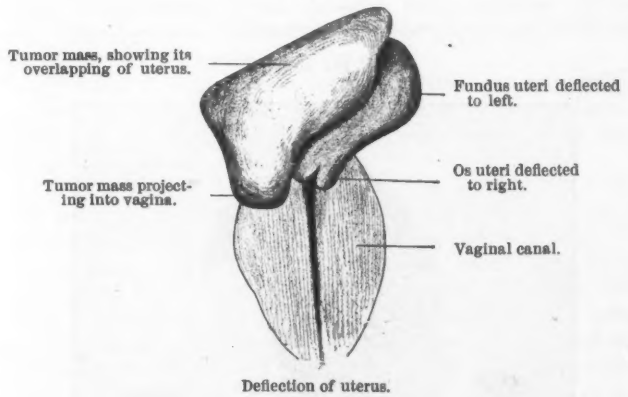
Present History. On April 18th the patient was exposed to cold and wet, being alarmed thereby, because she expected her menstrual period to appear on April 19th. This, however, did not occur until April 22d, hence was delayed three days. From this time, namely, April 22d, to time she sought counsel, May 6th, she had flowed irregularly, the flow appearing suddenly and copiously at times, with some clots and of a dark color; then abating from a few hours to a few days. Pain, referred to the lower right abdominal region, and at times radiating downward over the anterior surface of the thigh, accompanied these periods of flowing. On several occasions faintness was marked. The patient was about during this time. The above irregular discharge and general condition continued up to May 12th, when she again consulted Dr. Heyer, her family physician. The patient was ordered to bed to insure rest and quiet, and, abortion being suspected, examination per vagina was made, with negative evidence. No sign or symptom of pregnancy could be adduced by a general physical examination. Throughout the whole vaginal vault tenderness was elicited upon pressure, more particularly on the *left* side. No tumor mass was detected, in fact, except for tenderness, this careful general examination was entirely negative. With conditions as above stated the patient remained in bed for the most part, when, during the night of May 19th she was seized

with a very sudden sharp pain in the lower right abdominal region, accompanied by faintness and nausea. In the afternoon of May 20th Dr. Heyer was summoned, and upon examination a tumor was discovered occupying the lower right abdominal region. I was requested to see the patient in consultation, and at 6 P.M. found the following condition to exist:

The patient was in bed lying upon her back, with knees drawn up. Expression anxious and face pinched. Paleness of mucous surfaces quite marked. Mind clear and mental faculties fully acting. Temperature, 99.5° F.; pulse, 100, regular in rhythm, but irregular in volume, soft, small, rather pronounced upstroke. Respirations 30, shallow and thoracic in character. The patient complained of a tense dull pain in lower part of abdomen; slight headache; faintness, and no appetite. Thirst was not marked.

Physical Examination. Chest: Lungs normal. Heart rapid, regular, decreased muscular sound; valvular sounds normal.

FIG. 1.


Tumor mass, showing its overlapping of uterus.
Fundus uteri deflected to left.
Os uteri deflected to right.
Tumor mass projecting into vagina.
Vaginal canal.
Deflection of uterus.

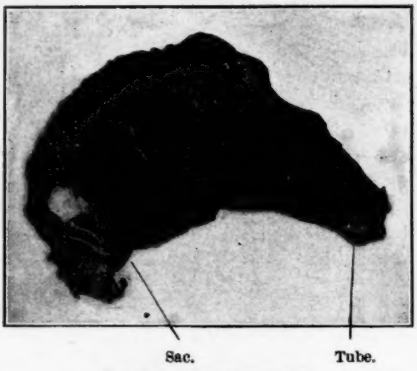
Abdomen: Inspection, slight rigidity of right rectus muscle and some bulging in lower right abdominal region apparent on deep inspiration. Otherwise negative.

Palpation. Above a line corresponding to the umbilicus palpation revealed no abnormal condition. Below this line tenderness was manifest generally, but more severe in the lower portion of the abdomen from the mesial line outward to a point corresponding to the junction of the outer and middle thirds of Poupart's ligament, and extending upward toward the umbilicus.

Pain on pressure was intense over this area, and produced faintness. A tumor was readily detected. The tumor mass was resistant and firm, the outer and upper border being sharply outlined.

Percussion. The percussion note over the various regions of the abdomen was normal, except over the tumor mass, where a dull note was elicited.

FIG. 2.



Sac, with cotton placed in it.

FIG. 3.

Other side of tube. Extent to which ovary was encroached upon in the sac formation. 1, 2, 3. Membrane and villi.

Vaginal Examination. The examining finger at once encountered a tumor mass projecting downward into the right side of

vaginal canal, reaching below the cervix. The cervix was soft, and the os slightly dilated, discharging a dark bloody flux. Intense pain was elicited upon pressure throughout the vaginal vault. Cervix directed toward the right side. (See Fig. 3.)

Bimanual Examinations. Fundus of uterus deflected toward the left side. (See Fig. 3.) Uterus very slightly movable and perceptibly enlarged. Left ovary and tube readily felt and apparently of normal size. The tumor mass was very tense, immovable, and its upper borders sharply defined. The inner border seemed to merge into the body of the uterus and embrace that organ. (See Fig. 3.) However, it was apparent that there was no direct connection between the tumor and the uterus. This mass filled the pelvis on that side and was triangular in outline (see Fig. 2), extending upward in the mesial line two-thirds the distance from the symphysis pubis to the umbilicus and outward to a point corresponding to the junction of the outer and middle third of Poupart's ligament.

The right ovary and tube could not be made out. A dark thick discharge filled the os, and blood clots were quite numerous in the vagina. Examination of this discharge failed to reveal any membrane. During the examination the patient complained of increased pain throughout the entire pelvic cavity.

A diagnosis of rupture of an ectopic gestation sac was made, and operative interference was advised at once. The patient was admitted to the hospital on May 21st, and I operated on her the afternoon of that day.

On examination of the pelvic cavity it was found that the rupture of the gestation sac had taken place into the broad ligament, and dissected along between the layers of that structure close up to the body of the uterus. The reason of blood escaping as the peritoneal cavity was entered is explained by the fact that I either opened the wall of the hæmatoma, or else from the pressure alone it ruptured. The tube and ovary were now extirpated, and one litre of salt solution put into the cavity of the abdomen and the wound sutured in layer except at the lower inch, through which gauze drains were placed. The patient withstood the operation well, and her recovery was uneventful. Primary union was obtained and the drainage removed on the third day. At the end of two weeks the patient was allowed the liberty of moving about in bed, and on the sixteenth day, a tight-fitting support being applied to the abdomen, she sat up. At the end of three weeks she was discharged from the hospital.

Examination of the extirpated tube and ovary shows the gestation to have been of the so-called tubo-ovarian variety. It seems to me quite remarkable that this variety of ectopic gestation should have ruptured into the broad ligament. (See Fig. 2.)

The sac occupied quite a portion of the ovarian tissue, as shown in Fig. 3, which also shows the fetal membrane in part.

At the present writing the patient is enjoying as good health as ever, and the only discomfort from her serious difficulty and severe ordeal is a feeling of stiffness in the right groin, only evident after indulging in rather excessive exercise, and on becoming fatigued. However, the patient tells me that this feeling is gradually disappearing.

CASE II.—Mrs. Y., aged twenty-nine years; weight, 119 pounds; height, five feet two inches; American born of Scotch descent. Was married in June, 1898; housewife by occupation; was never pregnant.

Family History. Negative.

Personal History. As a child was not particularly strong. Never had any severe illness except an attack of diphtheria six years ago, and was not in her usual health for about a year thereafter.

Menstrual History. The patient commenced menstruating at the age of twelve years, and so far as she can remember was regular, and did not suffer at these times. The usual interval between the periods was twenty-five days, and the periods, as a rule, lasted five days. For three years after marriage there was no interference in the normal course of her menstrual history, but for the past two years she had suffered pain at these times on the first and second days.

This painful menstruation increased in severity as time went on, and in March, 1903, the patient consulted her family physician in regard to this, with the hope of obtaining relief. In conversation with Dr. H. W. Nichols, of Brooklyn, he told me that he found Mrs. Y. had a retroflexed and retroverted uterus. The patient was under his care about three months, and was then discharged, her trouble having been overcome, and the parts maintained in normal relations by a pessary. During the time under treatment the dysmenorrhœa abated.

I saw the patient for the first time on July 4th, and found her in bed suffering from pain in the lower abdominal region. At this time the patient's temperature was normal, pulse 80, and respiration 20. She did not feel sick, and only complained of pain which she described as being sharp and not constant. This pain was assumed by the patient to be due to the fact that she was menstruating. Inquiry into this menstrual period elicited the following facts: The patient menstruated on May 11th, the correct date for that function to appear, and this period was in every respect normal. However, she did not menstruate again until June 19th, and then only had a very slight show, darker in color than ever before, and not accompanied by pain. This slight discharge kept up until June 25th, on which day she was seized with intense pain in the lower left abdominal region, and became faint at the same time. She was compelled to remain in bed for a few hours until the pain and faintness abated, when she was up and around again as well as ever. The slight flow continued irregularly until June 28th, when pain and

faintness again came on, but this time was only transitory. From this time until July 3d she was free from pain, and enjoyed her usual health. The slight flow continued, however, during this time.

On July 3d, in the night, after an active day, the pain came on again with great intensity, and I saw the patient at 6 A.M. July 4th.

Physical Examination. Chest negative. Abdomen: Inspection negative. Percussion note normal over the various regions of the abdomen, but elicited tenderness over the left lower abdominal region. On palpation tenderness was evidenced in the lower abdominal region over the uterus and its appendages, especially marked on the left side. No tumor mass could be made out.

Bimanual Examination. The pessary was removed, causing sharp pain. Cervix soft and slightly dilated. Uterus soft, movable, and enlarged perceptibly. The right tube and ovary easily felt and apparently normal. The left ovary apparently normal in size. The left tube was enlarged to about the size of a hen's egg, very tender, tense, and pulsating. This tumor mass was slightly movable and not directly connected to the uterus. Pressure about the vaginal vault elicited tenderness and caused severe pain. There was a rather foul odor to the discharge, which was dark in color and contained many clots. No membrane could be found, though the flux was carefully examined for such.

I strongly suspected I had a case of ectopic gestation, and explained to the patient's friends that operation was the best procedure, and advised the same. Under the circumstances, however, it was reasonable perhaps to have such advice received dubiously, and I was forced to leave the patient, with orders to remain in bed, to be quiet, and confine herself to liquid diet.

Owing to the press of other work I did not see the patient again until 8 P.M. At that time she was in intense pain and had been so for several hours.

Repeating my advice for operation, I summoned counsel, and at 10 P.M. Dr. Heyer and I returned to the patient. Her condition was most serious. She was not in pain, but anxious and very restless, and showed marked evidence of profound hemorrhage. Pulse 148, small, irregular, both in force and volume. Respiration 36, shallow. The thermometer did not register. The mucous surfaces were exceedingly pale, patient gasping and unable to speak aloud, complaining of suffocation, and asking for more air. Skin dry and cold. Heart very rapid and first sound exceedingly weak. Inspection, palpation, and percussion of the abdomen negative.

Strychnine and nitroglycerin were used subcutaneously; large amounts of normal salt solution introduced into the rectum, and hot applications externally. Without any means at hand for opening the abdomen we continued symptomatic treatment, and the patient began to respond slowly.

Operation was now demanded, but with no one at hand who had the power to give consent to such procedure, and expecting the arrival of the patient's physician at any time, I could only continue measures against shock and hemorrhage.

Upon the arrival of Dr. H. W. Nichols, of Brooklyn, we found the patient in much better condition. Temperature 100°, pulse 120, very weak and irregular. Respiration, 30.

The patient was removed to the hospital, and I operated upon her, opening the abdomen in the median line from the umbilicus to the pubes.

Upon entering the peritoneal cavity a great amount of fluid blood and blood clots escaped.

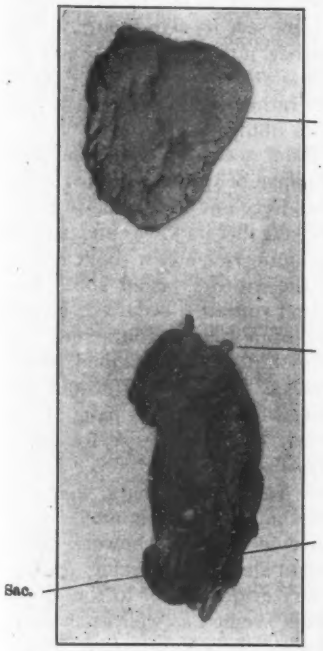
The tube was quickly found, tied off with a silk ligature, and extirpated. Search for fresh hemorrhage was made but none found. The abdomen was cleansed of the contained blood by flooding with normal salt solution in great amounts until it returned comparatively clear. The cavity was now partially dried, and search for the ovary made. This organ was found on the posterior surface of the broad ligament, and extirpated. The other pelvic organs were in good condition apparently. One litre of normal saline solution was now run into the abdominal cavity slowly, drainage established, and the wound closed by suture in layers. The patient acted fairly well under the anæsthetic, except on two occasions, when she became very weak. However, she left the table in far better condition than when I commenced the operation. Large amounts of saline solution were introduced per rectum, and this was kept up for thirty-six hours, almost all of it being retained, its administration taking place every four to six hours. The beneficial effect of this was very gratifying indeed. On the fourth day after operation the patient developed a sympathetic inflammation of the left parotid gland. No attention was paid to this, except wet dressings of a 5 per cent. solution of aluminum acetate were applied, and the inflammation disappeared in two days. Liquid foods were given in small doses frequently, as the stomach would allow, and champagne, brandy, with carbonated water, were given freely. Though these liquids were given very soon after the patient was returned to her room, yet they were borne exceedingly well and seemed to do much good. The patient made speedy progress toward recovery.

On the fourteenth day after operation, the wound having united throughout, she was allowed the liberty of moving about in bed, and on the eighteenth day she was sitting up in a wheel chair. At the end of three weeks the patient was up and about, a tight-fitting belt being used to support the abdominal wall. At the present writing the patient is practically a well woman, feeling in good health and showing only some anæmia, which is fast disappearing.

Examination of the tube shows this to have been a true tubal pregnancy.

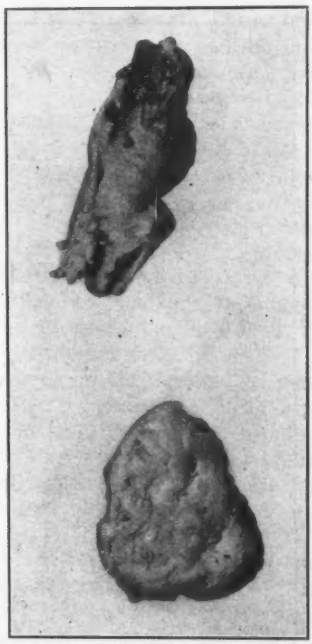
The tube shows gross evidence of pathological change, it being thickened and tortuous, and a small cyst appeared at the extremity nearest the uterus. (See Figs. 4, 5 and 6). These are photographs of the tube and ovary, showing the gestation sac and point of rupture.

FIG. 4.



Ovary and tube, showing sac and point of rupture.

FIG. 5.



Same as Fig. 4, with tube turned to side, showing size of gestation sac.

CASE III. *A Case of Intestinal Obstruction due to Meckel's Diverticulum.*—Infant A., male, aged seven months; white, American. Father and mother living and in good health. No family history of tubercular disease nor of any abnormal growths or deformities.

Mother had no difficulty with this the first child. Child breast-fed, never had any other food but mother's milk until six months old, then had been given water freely and dry bread-crusts occasionally, but apparently never swallowed any amount of bread. Since birth the child had suffered from constipation at times, but

had never had an attack of diarrhœa. The child had been under the care of two physicians at its home in Philadelphia for what seemingly were attacks of constipation. The child's bowels moved naturally twice daily on an average. However, a day or two before these attacks, which grew more frequent from birth until one week was the rule, the child's bowels would not move copiously as was the custom, and only once in twenty-four or thirty-six hours. Then the attacks of constipation came on, never lasting over thirty-six to seventy-two hours. The mother noticed that the movements were not at any time hard, but rather soft, and always free from undigested food.

FIG. 6.

Other side of tube, showing sac protruding; also cystic portion of tube. A. Cyst.

Pain seemed to be the first evidence of trouble, and the child would cry out from time to time, drawing up its knees and straining quite violently without result. If the attacks lasted some few hours, vomiting occurred, generally of a bilious character. No temperature accompanied these attacks. The child would lie quiet when free from pain, oftentimes showing a desire for food. These attacks have never lasted over forty-eight hours, and the termination was signified by a movement of the bowels, never constipated in character, giving a very evident relief to the child, which seemed as well as ever as soon as the bowels moved. Such is the history I obtained from the mother on the day of my first visit. Her physicians had examined the child often during these attacks, but evidently found nothing to account for this condition. The mother was advised not to feed the child at these times, except giving it water and small, frequent doses of some liquid food. Castor oil and a laxative tablet were used as a purge, and injections of hot water administered two or three times daily. Under such care the child had always recovered from these attacks, apparently none the worse for such experience.

The child arrived in this city on June 25th, with the father and mother, for the summer, coming from Philadelphia. At the begin-

ning of the trip the child was well, but during the ride on the train became somewhat fretful and cross, acting in the same manner as it had always done previous to one of these attacks of constipation. The bowels had not moved throughout that day until after its arrival in this city, when a very small movement occurred, accompanied by pain and considerable straining. The movement was soft in consistency and contained no undigested particles.

Throughout the night of the 25th the child was comfortable, and the bowels not moving on the morning of the 26th, the mother used the laxative tablet and enema without result. Throughout the day and night of the 26th the bowels did not move and the child lay quiet, taking little notice of surroundings, crying out with pain from time to time, and straining violently. The morning of the 27th there was no change, and vomiting of a bilious character began. The mother again used enemas, without result.

I was summoned to see the child at noon of the 27th, and found the following conditions to exist: Child well nourished and nicely proportioned, lying upon its back with legs extended. No temperature. Pulse 130, good quality. Respiration a little quickened. Examination of chest negative. Examination of abdomen: On inspection abdomen flat, no distention, no rigidity. Abdominal respiratory movement evident. Palpation: Abdomen flaccid, no point of tenderness, no pain caused by examination.

Low down in the abdomen, evidently in the sigmoid, a mass about the size of a pigeon egg was detected, giving the sense to the touch of fecal matter. Throughout the rest of the abdomen palpation was negative. The percussion note was normal throughout the various regions of the abdomen. Examination by rectum revealed nothing. The tongue was slightly coated and the vomitus without any odor.

With the history of the case as above written I felt that I was probably dealing with a case of temporary obstruction due to fecal matter in an abnormally long sigmoid flexure. Such was the diagnosis, and a high enema of oil followed by water was used without any result except a discharge of mucus and gas. The child was kept quiet, and egg albumen in water with small amounts of brandy given hourly. The mother was instructed to give enema of oil and glycerin every four hours.

The child remained in this condition without any change throughout the rest of the day.

At 8.30 in the evening I again saw the child, and found upon examination no change in any respect. The child was quiet except when crying out with abdominal pain. I next saw the patient the following day at noon, and found the child had had no movement of the bowels and also was decidedly sick, lying in a somewhat stupid condition, but easily aroused; on examining the abdomen a tumor mass of intense firmness was found lying in the mesial

line between the umbilicus and the pubes, the long axis inclined from above downward and to the left.

This mass was about the size of a hen's egg, and the percussion note over it dull.

Realizing the gravity of the situation and fearing a permanent obstruction had taken place I requested counsel.

At 1 P.M. Doctor Heyer and myself found the patient in this same stupid condition, and at this time the tumor mass described had increased in size to that of a small orange, was evident on inspection, easily palpated, movable, and dull on percussion.

Believing a volvulus had occurred, about a quart of oil and glycerin was run into the rectum slowly. No result upon the tumor mass was made, and no gas or fecal matter escaped. There was no peristaltic movement felt or seen to take place around the tumor mass. The child was vomiting greenish fluid in small quantities frequently at this time. About one-half hour after using the high enema, while we were watching the abdomen, the child gave a sharp cry, and immediately we saw swelling take place over the site of the tumor mass described, which increased in size steadily until it was as large as a large orange and bulged forward to a considerable extent.

Upon laying my hand over this tumor the peristaltic movements of the intestine could be felt, and upon percussion a distinct tympanitic note was heard. Operation was advised immediately, and the patient was taken to the hospital.

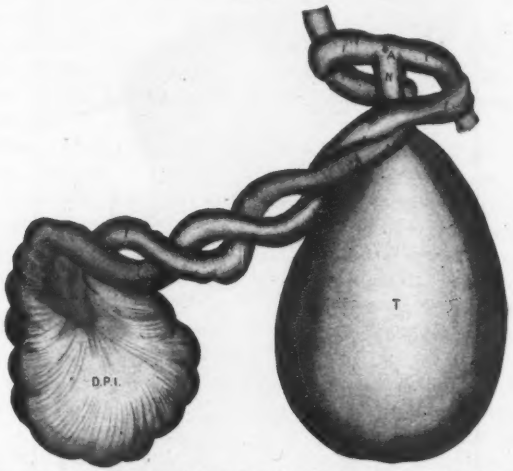
When seen at the end of another hour the child was vomiting fecal matter very often and seemed in a moribund state, temperature subnormal, thermometer in the rectum did not register. Respirations 40. Pulse very rapid and weak. The tumor mass appeared no larger to the eye, but on palpation a perceptible increase in size was evident.

Operation. The abdomen was entered by an incision in the median line from the umbilicus to the pubes. Upon opening the peritoneal cavity a white, glistening mass was seen lying against the abdominal wall, looking much like a distended portion of the intestine. On putting the fingers into the cavity this mass was pushed aside and the fingers swept about it. No adhesions being encountered, the mass was delivered from the cavity of the abdomen and with it a large proportion of the intestinal tract. This tumor mass was pear-shaped, about six inches in length, and some three and one-half inches across in the largest portion, firm to the touch and distended with fluid. (See Fig. 7.)

The wall was smooth and shining and covered with distended veins of large size. It was absolutely free from adhesions and was connected to the under surface of the ileum, some sixteen inches from the ileocolic junction, by its upper and smaller extremity through the medium of loose connective tissue for about three-quarters of an inch. (See Fig. 7.)

The ileum had looped itself around the upper extremity of the tumor, and was then turned four times upon itself from left to right around the tumor mass, leaving a loop of gut some six inches long free and distended enormously with gas.

FIG. 7.



Tumor mass and volvulus. Sixteen inches from ileocolic junction. A. Attachment of tumor to ileum. D.P.I. Distended portion of ileum. I. Ileum. K. Neck of tumor. T. Tumor mass, 6 x 3¼ inches.

The volvulus was reduced without difficulty. An incision was then made into the tumor mass, and some eight or ten ounces of a clear serous fluid escaped. The incision was now carried along the tumor down to its attachment to the intestine, and, no communication being detected between the cavity of the cyst and the intestine, the wall of the cyst was excised close to the gut. On account of the exceedingly precarious condition of the patient no time could be given to dissecting the tumor from the gut. The gut was in good condition, and circulation was well established in a few minutes by the use of hot towels. The gut as it was returned was run through the hand as a matter of precaution; incidentally the appendix which was abnormally long, was removed and the wound closed. The operation occupied some fifteen minutes. The patient rallied well from the operation, the fecal vomiting ceased, the bowels moved freely, and large amounts of gas escaped per rectum.

The aspect of the patient improved remarkably in a few hours. Though the operation was followed by almost unlooked for relief in every particular, yet no hope was entertained for recovery, and about ten hours after operation, as the child was moved upon its

pillow, it suddenly collapsed and died in a few minutes thereafter. Examination of the wall of this tumor mass showed it to be of intense toughness and very elastic, about one-eighth of an inch in thickness. (See Fig. 8.)

FIG. 8.

Wall of tumor mass.

The neck of the sac presented grooves from the pressure of the intestine as they were twisted about it. This tumor was suspected to be an intestinal diverticulum, possibly Meckel's, and the report of the pathologist to the Hartford Hospital, Hartford, Conn., prooves it to be such.

Dr. Walter R. Steiner, Pathologist to the Hartford Hospital, Hartford, Conn., furnished me with the following pathological report of the case:

The tissue coming from the wall of a cyst connected with the intestine was hardened in graded alcohols, embedded in celloidin, and the sections when cut were stained in hæmatoxylin and eosin.

The specimens on cross-section are seen to be composed of four layers or coats. The inner layer is made up of fibroelastic tissue, loosely compacted together and containing bloodvessels and lymphatics. In places there is a considerable amount of round-cell infiltration, especially about the bloodvessels. The next two layers are composed of muscular tissue—an inner circular layer and an outer longitudinal layer. The inner (circular) layer is the more compact of the two. The last or outer layer is fibrous in character and fairly vascular.

Diagnosis. From the location of the specimen and its structure (as seen on section), it seems probable that the cyst owes its existence to an intestinal diverticulum, which subsequently did not communicate directly with the intestine, but remained connected with it by adhesion (pedicle). The coats of the cyst correspond to the submucosa, the two muscular coats and the serosa, of the intestine. There are, however, no evidences of a mucosa. The location of the cyst with reference to the cæcum suggests strongly the possibility that it is a Meckel diverticulum.

The enormous size of this process in this case led me to make the above report, for I have been unable to find the history of its parallel. To theorize, perhaps, concerning this tumor mass we might say in the first place that it seems most plausible that the attacks of so-called constipation were in reality referable to this diverticulum, possibly by a temporary looping of the gut about it or by pressure of the structure upon a portion of the gut.

I cannot believe in the face of the history of the case and after the careful examination of the abdomen, made by several physicians in the course of the infant's life, that such a tumor of the size described could have existed all this time without detection. And again, as I have already stated, the tumor I felt on June 28th steadily grew in proportions, making one strongly incline to the theory that by a constriction at the neck of the tumor a passive congestion took place and serum continually escaped from the very numerous vessels in the wall of the cyst, causing the tumor to enlarge. That the volvulus was of short duration, I am positive, for I could almost see it develop, so to speak. A post-mortem could not be obtained, but I have every reason to believe that the contents of the abdomen were in good condition after operation, and that shock was probably the chief factor in the cause of death.

The enormous size of Meckel's diverticulum and the interest which surrounds the life-history of this little patient, evidently referable to that structure, and the rarity of ectopic gestation have led me to report these cases to my colleagues.

I am sure we may truthfully say that three desperate cases con-

fronted us, two of which are able to pay their tribute to the art of surgery.

I want to call attention to the use of saline solution in the peritoneal cavity as a means of counteracting shock and supplying the body with fluid material.

In these two cases of ectopic gestation both patients had lost a great amount of blood, one being nearly exsanguinated. Upon the table both cases became in desperate condition, one particularly so. The opening of the peritoneal cavity, though occupying perhaps two minutes, with the loss of the contained blood, impressed both patients very markedly, but very soon after the saline solution was run in the peritoneal cavity—and this was the next step in the operation after securing the tube by ligature—the beneficial effect was observed both in the circulation and in the general appearance of the patient. In fact, it was not perceptibly longer than has been the case where I have used salines intravenously. So marked was the good result that the patients in both instances were kept upon the table some forty or fifty minutes, whereas the operation could have been completed in fifteen or twenty minutes. This solution was not only absorbed rapidly, but its effect was most marked, and it cleansed the cavity effectually, doing away with having to use so foreign a substance as the operator's hands or instruments among the intestines and against so sensitive a membrane as the peritoneum. Also the edges of the wound were insured against injury.

A rather significant fact is this: that no atony of the intestinal tract followed these operations.

In the case of the infant the beneficial effect of the saline, though used, was not so noticeable; but here no loss of blood had occurred. I feel certain, however, that the element of shock was at least mitigated. We know the peritoneum has a most wonderful capacity for absorption, and my experience in these and other cases has led me to use the abdominal method of administering salines in cases of abdominal surgery, where from loss of blood or from shock such would be indicated.

A case of double ovariotomy illustrates this practice well. The patient lost no blood, but owing to adhesions I had spent some thirty minutes before I could extirpate the tubes and ovaries. About this time the patient showed marked evidence of shock and collapse. I ceased further manipulation, and ran into the peritoneal cavity some three pints of salt solution. It was only a short time when the patient rallied, her pulse came up, and the operation was then completed without any further difficulty. She made an uneventful recovery. Owing to oversight on the part of a nurse no stimulation was at hand, and when ready was not needed.

LUDWIG'S ANGINA.

REPORT OF A CASE.

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Ludwig's angina is an infectious inflammation of the cellular tissue in the floor of the mouth, beneath the jaw, also behind it and down the neck as far often as the clavicle and sternum. The following case illustrates its pathology and treatment. It is often fatal.

C. R., male, aged twenty years, had had a bad tooth in the lower jaw, right side, for some time. A week previously the neck began to swell and later rapidly increased, until on admission he was only able to part the jaws less than a centimetre; the tongue was thick and filled the mouth, and it was also pushed upward by the swelling on the floor of the mouth. The neck was enormously swollen, the swelling extending from the zygoma above to the clavicle and sternum below, and from the edge of the trapezius muscle on one side to beyond the median line on the other. He had stertorous breathing, difficulty in swallowing, and could only talk in a whisper. Under primary anæsthesia an incision was made in the line of the anterior edge of the sternomastoid muscle and two rubber drainage-tubes passed parallel to the jaw and brought out near the median line. Only a very small amount—a few drops—of pus was obtained. The temperature was 101° F.; pulse 120; respiration 24.

The case is interesting for several reasons. The photograph, which was taken about the second or third day after operation, shows the swelling extending up to the zygoma. The swelling around the lower part of the neck is not shown, having disappeared, owing to the drainage.

The fact that the patient could only speak in a whisper and the noisy respiration showed that there was œdema of the larynx and probably compression of the trachea. That the œsophagus was compressed was shown by the trouble in swallowing. The greatest swelling was between the jaw and the clavicle. Immediate relief was required. While there was a feeling of fluctuation, no collection of liquid was found on operating. It was decided to place the incision some distance below the angle of the jaw, so as to avoid any superficial veins, for there is not infrequently a communication between the external and internal jugulars at this point, or the temporomaxillary and facial veins may there be encountered. As soon as the deep fascia was opened a closed hæmostat was pushed ahead into the tissues and opened. In this way two passages were tunnelled upward to beneath the lower jaw; also two across the neck, one curving upward toward the jaw and the other downward toward

the clavicle and sternum. Drainage-tubes were placed in each. No distinct collection of pus was found. The tubes were surrounded with gauze. A culture showed an unmixed growth of virulent streptococci. The symptoms improved slightly by the next day, but not to the extent desired, and as there was practically no discharge from the tubes, the gauze dressing was removed and substituted by a flaxseed poultice. I thought that any further infection could only be for the better, and the poultice, I felt sure, would hasten and favor resolution. This it apparently did, for the next day the discharge of pus began, and the temperature had reached normal. On the fifth day after operation the discharge of pus was more free and the patient was taking solid food. He was dismissed on the tenth day, with the discharge almost stopped, and his general and local conditions excellent.

Some authors regard the disease as resembling erysipelas. This seems to me to be so only to a small extent. I believe it to be a distinctly local condition, propagated by travelling by direct continuity of tissue and capable of being relieved by free opening of the infected area. The safest way of making this opening is by pushing the nose of a hæmostatic forceps carefully into the tissue and opening the blades and so working one's way onward. The large bloodvessels of the neck did not appear to be pushedup near the surface by the effusion, but lay probably close to their normal position posteriorly. There was a direct causal relation between the diseased teeth and the onset of the inflammation. This fact, together with the prompt subsidence of both local and constitutional symptoms, as the result of local treatment alone, all point to the disease as being a distinct local infection and not erysipelatous in character. Complete anæsthesia is dangerous in these cases, and the safest course would be to use local anæsthesia or none. In this case it was simply used to deaden the skin incision.

A FATAL CASE OF POISONING WITH OIL OF GAULTHERIA.

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AND

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The rarity of cases of fatal poisoning with oil of gaultheria makes the case we are about to report of some interest. It occurred at the Polyclinic Hospital in the service of Dr. McKee, through whose courtesy we are enabled to report it.

The patient, Fannie H., a child, aged two years, was brought to the hospital about 9.30 A.M., on April 18, 1903, by its mother, who said that it had swallowed the contents of a bottle, which she brought with her. As the bottle had been bought by the patient's father at the pharmacy in the hospital, it was easy to determine that it contained commercial oil of wintergreen, which is in reality oil of birch. It was estimated that the child had taken a drachm of the drug. The child had vomited several times before being brought to the hospital, and continued to do so until lavage could be done. Examination showed a temperature of 98.6° F.; pulse 100, regular, and of good volume; respirations 26, and regular.

There was nothing abnormal in the child's appearance, and it showed no evidences of suffering pain. There were no further symptoms for two hours, when the patient seemed to have pain in the abdomen, was drowsy, and complained of great thirst. The pulse rate increased to 150, and within an hour the child's face became flushed, the respirations were somewhat labored and irregular, and there were evidences of impaired hearing and some hallucinations of vision. The temperature was not increased, but there were slight twitchings of the hands and the muscles of the neck, and at this time delirium was first noticed. There was diarrhœa and a strong odor of oil of gaultheria in the stools.

At 3 P.M. the temperature was 99.4° F.; pulse 132, and of good volume; respiration regular, but somewhat labored. At 3.30 P.M., seven hours after the drug had been taken, the child had a general convulsion, in which the arms and legs were extended, eyes rotated upward, head thrown back, neck rigid, but there was no arching of the back. The pupils were equal and were moderately dilated. This tonic spasm lasted about half a minute and recurred at frequent intervals. The pulse was of fair volume, but was slightly irregular, and the respirations were deep, labored, and gradually decreased in rate to four or five per minute. These symptoms increased until, finally, the child died of respiratory failure at 6.30 P.M.,

ten hours after the ingestion of the poison. About three hours before death the child was catheterized, and salicyluric acid was found in the urine. An autopsy was not obtained.

In view of the frequent use of oil of wintergreen as a therapeutic agent and the comparative rarity of poisoning by this drug, it may be of interest to note that von Rottenbiller[1] believes that the poisonous effects are due to impure preparations, the result of imperfect methods. He cites cases of poisoning by oleum ricini, due to ricin in impure preparations, and thinks poisoning by oleum gaultheriæ analogous to these.

Hare and Wood,[2] from experiments on dogs, concluded that oil of gaultheria acted as a respiratory and vasomotor stimulant. While this result is verified by the reports of some who have observed cases of poisoning in man, it will be seen that in the case reported above there was at no time any evidence of respiratory stimulation, the only effect observed being depression, which became so marked as to be the immediate cause of death.

Gallaher[3] reports the case of a boy who after taking half an ounce of oleum gaultheriæ had marked gastrointestinal symptoms and an inordinate appetite, but no nervous symptoms. He recovered in two weeks, under a treatment which consisted of bleeding, leeching, and cupping.

Hamilton[4] reports a case in which there was almost entire absence of gastrointestinal symptoms. In his case a young woman took half an ounce of oleum gaultheriæ after having swallowed an equal amount of oleum morrhuæ. She had hallucinations of hearing and vision, extreme stupor, rapid pulse and respirations, and left hemiparesis. She recovered.

Pinkham[5] reports a case which lends added interest to the subject in showing its medicolegal importance. A woman took one ounce of oleum gaultheriæ to produce abortion. She died in fifteen hours, after showing symptoms of gastrointestinal and nervous disturbance.

Jewett,[6] Halderman,[7] and Pillsbury[8] report fatal cases following the ingestion of from three drachms in Halderman's to two ounces in Pillsbury's case. In the latter case an unusual symptom was erythema and an intense itching of the skin.

Abel[9] reports a case seen by Dr. Ott in which the symptoms resembled those seen in acute alcoholism. The patient was a child aged three years, who died eighteen hours after taking one-half pint of oil of birch.

Van Wagenen[10] saw two fatal cases, one in a boy, aged two years, who died twenty-four hours after taking one drachm.

Beck[11] mentions a fatal case, and also refers to the cases of six soldiers who were made ill after drinking a tea which contained, among other ingredients, some oil of wintergreen. They all recovered.

Potter[12] refers to a case which is probably the same one mentioned by Beck, but he gives no reference.

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THE SIGNIFICANCE OF URINALYSIS IN PREGNANCY, WITH ESPECIAL REFERENCE TO ECLAMPSIA.

By Robert N. Willson, M.D.,

of Philadelphia.

Opinions are so various at the present time with regard to the significance of urinary conditions during pregnancy, and especially with regard to the presence or absence of glucose or albumin, that a few pertinent cases in the experience of the writer have led him to briefly discuss the following questions:

1. What are the customary findings of urinalysis during a (clinically) normal pregnancy?

2. What variations from the normal may be noted, and what is their significance?

3. What dependence can be placed upon urinalysis as a warning of impending eclampsia?

The first question is by no means the most easily answered of the three, if one bases his reply upon the statements gathered from the current discussion of the subject by those who do purely obstetrical work. There seems to be as much diversity of opinion as to whether albumin or glucose may be found in the urine of a strictly normal pregnancy as there is with regard to the origin of these substances. One author states that a trace of either albumin or glucose has no significance, while another assures the student that the appearance of either renders the prognosis grave for the mother and child.

It may be stated as a general working rule, none the less, that the urinary picture which is normal for the ordinary conditions of

life is also indicative of normal conditions in pregnancy. Just how far this principle will maintain itself will be discussed at a later point.

Question 1 then narrows itself down to the subquery: Can there be variations from the ordinary normal urinary picture which will still admit of a clinically normal labor?

The answer must be a prompt one in the affirmative. Not only do parturient women sometimes give normal birth to healthy children in spite of urinary conditions indicative of possible misfortune; but sometimes the urine in such cases appears of such a character chemically and under the microscope as to promise a rapid fatality if the labor be not at once terminated.

The specific gravity may be constantly depressed, the quantity of urine may be large or small, the excretion of urea may be diminished or increased; or there may be albumin, glucose, or both, present in large or in small quantities; and still the labor may be an easy one, and clinically normal for mother and child in every other respect.

A more frequent picture is that of a pregnancy during which (especially when the gravid womb is occupying considerable space in the abdominal cavity) a so-called trace of glucose or of serum albumin is detected by the ordinary tests. Still more frequent, and such a common occurrence as to cause no surprise when noted, is the presence of delicate quantities of serum albumin, detected only by careful methods and confirmed by control tests.

In a series of nearly 1800 urinalyses, made by the writer during the past two years, a considerable number of the examinations were in the cases of women in the later stages of pregnancy. Of the entire number of specimens of urine obtained from parturient women, only a comparatively small percentage (22 per cent.) were entirely free from albumin and sugar, while in no case in which glucose was noted was albumin absent. In nearly 60 per cent. at least a trace of albumin could be detected. In many of the cases the albuminuria began to manifest itself about the fifth month. In some it was not present until the last days before delivery. In a few it became evident directly before the appearance of active labor pains, its presence being discovered at times only by accident, if the term may be fairly employed.

When glucose appeared in the urine of a subject known to have not previously shown glycosuria, the occurrence, as a rule, took place at some time between the beginning and end of the last month of pregnancy. Occasionally there was a trace of glucose present throughout the pregnancy, often disappearing completely after the birth of the child. In no case in which, in the absence of other indications of acute or permanent renal change, small quantities of either serum albumin or glucose (not evident previously) were found present during pregnancy did the urine fail to regain its normal

character shortly after the birth of the child except in the few cases in which fatal eclampsia supervened.

In the majority of cases the urea elimination was that of the normal woman under ordinary circumstances other than those of child-bearing. Its excretion varied with the individual, and especially in relation to the diet and exercise. Occasionally the quantity excreted appeared persistently high, and just as often exceedingly low; but with no evident bearing upon the otherwise normal outcome of the case.

When the microscopic sediment indicated positive renal change the beginning of this change almost invariably appeared to have antedated the pregnancy, and, as a rule, continued after the puerperium as a permanent condition. Exceptions were noted even to this rule, however, and the following case furnished rather a striking example of the kind:

Mrs. W. E. T., aged twenty-one years, was seen by the writer in her seventh month of pregnancy on March 19, 1901. Her father had died of trauma, and the condition of his kidneys was unknown. Her mother had chronic nephritis, and died from acute meningitis.

The patient had always been strong and well except for two attacks of pneumonia, followed on both occasions by a complete recovery. Since then she had always been active. Menses regular; no leucorrhœa. She had been married one year, her last menstrual flow having occurred seven months before. No headaches or dizziness; no swelling of the face, feet, or hands. On physical examination she was found well nourished, her skin healthy, no jaundice or œdema. Chest absolutely negative; heart sounds all clear and regular; arteries soft. The abdomen was that of advanced pregnancy. On examination the gravid uterus was found to contain a living fetus in the L. O. A. position. The pelvic measurements were all ample and normal.

The *urinalysis* on March 21st resulted as follows: 1011, acid, pale straw in color, slightly turbid, sediment scanty, white, and flocculent; albumin none, sugar none; microscopically, full of squamous and cylindrical cells, no casts, few leukocytes, no mucus, no crystals.

A request was made during the following week that another specimen be sent, for the reasons that the specific gravity was so low and because there was doubt in the writer's mind as to the estimated time of the pregnancy.

On March 26th the *urinalysis* was 1013, acid, pale straw in color, albumin a decided trace, sugar none; microscopically, much squamous and cylindrical epithelium, many leukocytes, no casts, much mucus, no crystals.

An *examination* the following day (March 27th) showed 1027, albumin none, sugar none, heavy phosphatic clouding with heat; microscopically, full of uric acid crystals; no casts, much squamous epithelium, few leukocytes, considerable mucus.

The patient felt at this time strong and well. Fetal movements distinct. During the next month the urine remained negative except for a very high specific gravity, a urea output of 2.8 to 3.6 gm. per 100 c.c., occasional showers of uric acid crystals in the freshly voided urine, and once a heavy sediment of calcium oxalate crystals. No albumin; no casts. On April 15th the patient's feet began to swell. Although requested, the urine was not obtained until ten days later, when the urinalysis showed 1030, albumin, 6.6 gm. per litre; sugar none; urea, 2.51 gm. per 100 c.c. Microscopically, full of small hyaline and hyalogranular casts, many leukocytes, no renal epithelium, no crystals.

On the following day the albumin still measured over 6 gm. per litre, and there were present many granular casts and much renal epithelium, although the patient had been in bed and on a liquid diet for two days. Periodical pains began to be evident during the early evening of this day, gradually increasing, and after a labor of twelve hours the head of the child was on the perineum, and was delivered naturally, with a slight laceration. The latter was repaired at once, and both mother and child advanced through a normal puerperium and adolescence.

At no time in this case was there a suspicion of renal involvement up to the time of the single appearance of albumin in quantity, one month before term, and followed by its complete disappearance. Its reappearance at some time during the last ten days before the birth of the child; its presence in large quantities, and above all the indication by the microscopic sediment of serious renal change, all made labor a dangerous prospect and raised the question as to the best course to pursue. The event proved that sometimes Providence allows us to rush on in safety, when in a different mood we would counsel prompt artificial termination of the dangerous condition.

This will be recognized as a case in which every feature of the urinalysis indicated danger of the much-dreaded eclampsia, and as one which, none the less, passed on to a normal labor and delivery. The urine one month later was nearly free from albumin (faintest trace) and casts, but unfortunately the patient has moved away from this vicinity and has disappeared from view.

It may be briefly stated that cases have been noted in which the urine has contained as much as 4 per cent. or 5 per cent. of glucose during pregnancy, and yet the woman has gone safely through to term and a successful delivery. The same must be said of such instances as of the case just cited, that the probabilities are all against a favorable outcome. We are, however, more intimately concerned with the subject of albuminuric eclampsia, and will pass over other considerations for the present. It will be sufficient to say that cases are constantly being noted in which albumin is present throughout the course of the pregnancy; others in which it appears

early or late in its course; and in one or both, or neither, there may be casts and renal epithelium in abundance; and still there may be no departure from the normal in the labor.

In concluding his comment on this question, and partly by way of discussing Question 2 (What variations from the normal may be noted, and what is their significance?), the writer would simply say that most cases of pregnancy present minute traces of serum albumin in the urine, and that these can be detected if sufficient care be devoted to the search. Probably these traces are the result of pressure by the gravid uterus and of the consequent congested state of the kidneys. Sometimes there seems to be actual renal disease, and the ultimate cause may never become evident. Such cases must be placed in the category with those other problems that are too deep for our understanding; and when they go on to normal labor we should be thankful for the occurrence and content to accept the gift of Providence. Too often the urinary indications of renal involvement are verified by the dreaded onset of eclampsia, and too often, also, in such cases the opportunity is afforded on the autopsy-table to ascertain the extent of renal damage.

Much stress has been laid by some writers upon a diminution in the elimination of urea in certain cases of pregnancy, both as an indication of impaired renal activity and of the danger of eclampsia. Certain it is that in most pregnant women the specific gravity of the urine is high (1025 and upward), and the urea output correspondingly large; or, to state the sequence of affairs more accurately, the urea is excreted in abundant quantities, and the specific gravity is correspondingly high. The true significance of the variations in the elimination of urea must be estimated as in all other conditions —viz., when the kidneys are doing their proper share of work they will excrete a normal amount of urea; when hampered or diseased, their urea output is diminished and sometimes becomes exceedingly scanty. The doubtful claim that a decided fall in the amount of excreted urea is ever a dependable indication of oncoming eclampsia will be referred to again in connection with the cases cited under Question 3. The highest importance must always be attached to the presence of renal epithelium in quantity; also to tube casts, especially when in large numbers, and when of the granular, blood, or epithelial varieties. Normal urine always contains a few hyaline casts, which may be found if looked for with care. No normal urine contains many of the latter, however, and normal kidneys are never responsible for casts of the granular or epithelial types. The microscopic sediment in the majority of instances furnishes our most accurate guide as to the condition of the renal apparatus, and its critical study should never be omitted from the urinary examination.

It remains to recall the fact that sugar (glucose, lactose, etc.) may often appear in small quantities, and that when confined to such

inconsiderable amounts it has little or no practical significance, at least in the light of our present knowledge. When glucose is present in pathological or in permanent form it is interesting to note that there is present also, with few exceptions, some indication of renal change. We have yet to discover the real cause of the appearance of glucose, even in diabetes, but we have learned clinically that diabetic glycosuria is usually accompanied by renal sclerosis, and that its urine contains a renal sediment; and we have learned that the association is such a close one as to be valuable clinically for diagnostic purposes. The rule holds equally well in the pregnant woman and the non-pregnant diabetic. The presence of glucose, as already stated, is in itself by no means a grave sign, and in small quantities unattended by signs of renal incompetency can usually be ignored as far as concerns the outcome of the pregnancy. When it represents a diabetic condition, however, it assumes a new importance, furnishing the picture of a subject of a cachexia undergoing the greatest strain imposed by nature upon woman's vitality. Pregnancy under such conditions becomes a dangerous and questionable duty, instead of woman's trying but precious privilege.

In conclusion, Question 3 (What dependence can be placed upon urinalysis as a warning against impending eclampsia?) raises again an all-important and much-mooted discussion. The writer has already cited a case in which the urinary condition indicated serious renal change, and yet in which labor was carried on with entire exemption from eclampsia. He remembers with vividness a second case in the hands of a prominent obstetrician in which the urine had always been found normal prior to the pregnancy. Unfortunately, the urinalysis was omitted during the course of the pregnancy owing to confidence in the integrity of the renal function; and this case died in eclamptic convulsions. A third case is still under the care of the writer, and is interesting in that it presents the picture of a urine absolutely normal on the evening prior to the beginning of labor, a total absence of a history of nephritis, and yet a series of convulsions beginning while the fetal head was on the pelvic floor and continuing into the post-partum stage after an instrumental delivery. The following presents merely an outline of the case:

Mrs. J. F. E., aged twenty-six years; family history negative. One child living and well; forceps delivery after a long but otherwise uneventful labor. Seen for the first time by the writer on March 14, 1903, at which time the patient considered herself six months pregnant. The abdomen was very large, but the patient stated that this was also true of the first pregnancy. The right leg was swollen, also the right labium, the veins of which and of the right vaginal wall were swollen and tortuous. This condition was greatly relieved in the recumbent posture, and was evidently due to pressure in the abdominal cavity. The vertex was distinctly felt on vaginal exam-

ination, approximately in the L. O. A. position. Pelvic measurements were all normal.

The urine at that time was examined and showed, A. M.: 1010; albumin, faint trace; sugar, none; urea, 1.22 gm. per 100 c.c.; microscopically, full of squamous cells, no renal sediment, few leukocytes, no crystals; P. M.: 1020, acid, etc.; albumin, faint trace; sugar, none; urea, 2.80 gm.; no renal sediment, full of squamous cells.

From this time until May 18th, inclusive, the urine was examined weekly. On the latter date both the morning and evening specimens were examined. At no time during this period could albumin or sugar be detected. No casts and no renal epithelium were present. The urea averaged 2 gm. per 100 c.c., and on the last examination before labor began was 2.18 gm. On May 19 the writer was called because of colicky pains over the abdomen. There was some headache, and it was learned that the bowel had not been emptied for two days. At this time the patient was supposed to be about one month from term, but the abdomen appeared so large that oncoming labor was suspected, and the vaginal examination showed the cervix already dilating. After a long, slow labor of twelve hours the vertex was on the perineum. Convulsions suddenly supervened, following the second of which forceps delivery was carried out with the assistance of Dr. W. A. N. Dorland, and without injury to mother or child. The placenta was at once delivered with the hand in the uterus. An hour later a third convulsion took place, followed by a fourth, fifth, and sixth. The urine drawn by catheter showed the following: 1012, acid, etc., strong odor of decomposition; albumin, 1 gm. per litre; sugar, none; urea, 1.18 gm. per 100 c.c.; considerable number of hyaline and hyalogranular casts; no blood; considerable renal epithelium.

The patient was bled, and then transfused into a vein with normal salt solution. She was then kept in a steam bath almost continuously for six hours, when the kidneys again began to take up their share of the work. Consciousness was not fully regained for thirty-six hours, though no convulsions occurred after transfusion.

The urine rapidly cleared up, until at the present time it is perfectly normal, and the patient free from evident impairment of the renal functions, and with no recollection of the ordeal.

Dr. Dorland has informed the writer of a case of eclampsia, recently seen by him, in which the urine was examined immediately before labor, and found to be normal, but in which convulsions appeared and death ensued before morning.

We have studied cases, therefore, which have presented urinary pictures of seemingly grave import, but in which labor has followed a normal course; and, on the other hand, cases of dangerously obstinate, and even fatal eclampsia occurring in spite of kidneys in which, up to the moment of labor, were supposedly healthy. As a result of our study we are confronted with the question: Can

eclampsia be accurately foreseen and avoided by the careful attendant upon the case; and does albuminuria, or even a renal sediment, predict with any degree of accuracy parturient or puerperal eclampsia? By way of answer the following conclusions seem warranted at the present time:

1. Careful urinalyses should be carried out in all cases of pregnancy at frequent intervals, and with increased frequency as term is approached.

2. The most dependable indications of impaired renal function and of probable eclampsia have been shown by general experience to be the presence of decided quantities of serum albumin, the diminution of the eliminated urea, and the presence of a microscopic renal sediment (casts, renal epithelium, blood, etc.). The character of the latter, when accompanied by the well-known clinical signs of nephritis, always constitutes a working basis for an estimate of the probability of imminent danger.

3. Even if the urine appear perfectly normal the possibility of eclampsia must be considered, especially in young women. Eclampsia in such cases is of equal severity with that of cases in which the urine has given due warning of impaired renal functions.

4. When eclampsia supervenes upon labor in a subject with previously (apparently) healthy kidneys, the tendency subsequently is toward a return to normal renal functions if the patient survives. This circumstance would seem to indicate still more strongly that the kidneys may actually have been normal up to the time of a temporary embarrassment and suspension of function.

5. Until the nature and ultimate cause of uræmia and eclampsia are more thoroughly understood, it would appear that urinalysis, though not an unerring guide, is our most valuable index of the condition of the kidneys and our most trustworthy source of information as to danger from such forms of toxæmia.

6. The prognosis seems to be vastly improved if eclampsia be combated by generous bleeding, followed by venous transfusion with normal salt solution. These measures reduce and dilute the poison in the circulation, and relieve the cardiac distress. Free diaphoresis and purging are of course indicated.

A NEW METHOD OF GASTRIC PROTEOLYSIS.[1]

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The essential chemical function of the stomach is the digestion of proteids. While digestion of fats has recently been shown to take place in the stomach, as well as in the intestine, it is always insignifi-

[1] Presented in abstract to the American Gastroenterological Association, 1903.

cant quantitatively. Digestion of (cooked) starches occurs within but not by the stomach, and may be very considerable, although no complete systematic study of this phase of digestion has been made as yet, and it is obvious that this phase of gastric digestion must be extremely variable. The method of gastric analysis submitted by the writer in 1900 to the Prize Committee of the American Medical Association, and published in the *Journal* of that body March 27-30, 1901, differed from the various clinical methods in vogue, in attempting to investigate directly the actual amount of digestive function performed, instead of measuring the acid, ferment or other potential energy remaining after the extraction of the stomach contents.

On account of the small quantity of raw material available in practical gastric analysis, the necessity of performing many manœuvres upon the clear filtrate, which seldom exceeds 50 per cent. of the total quantity extracted, and the necessity of using separate portions of the filtrate for other methods of examination, as those for acidity, peptic strength, and qualitative composition, it became evident to the writer, very early in his preliminary study of the problem, that exact scientific analysis of proteids was out of the question, even if it could be adapted to the use of the clinician. For this reason it was decided to employ the general method of centrifugal precipitation, and to throw out of solution the various proteids in successive groups corresponding to the degree of peptonization, and employing as precipitants substances which should produce fairly bulky precipitates, which should not precipitate non-proteid ingredients of chyme, nor result in confusing mutual reactions. By consulting the qualitative tables of proteid precipitants collated by Ewald, Gamgee, and others, some idea may be formed of the very considerable amount of preliminary study required, as, for one or other of the reasons mentioned, most of the reagents suggested were found inapplicable to the problem propounded.

Anyone who has used the centrifuge to any extent in clinical estimations of any kind, will assent to the statement that the only safe rule is to base a volumetric reading on the minimum obtained after several successive centrifugalizations at a considerable speed. Whether the hand, water, or electric centrifuge is employed, the maximum speed obtainable for tubes of considerable size, without great risk of breaking the glass and spoiling the result, is 2000 to 2500 revolutions per minute. The writer has obtained identical results with the hand and water instruments, and has always centrifugalized until the precipitate suffered no further diminution in volume. Usually three centrifugalizations of two minutes or more each have been used.

As originally reported, three precipitates were compared, dealing in all instances with an investigandum of 10 c.c. of clear filtrate from chyme, and using graduated tubes, which enabled the readings to be made directly in percentages of this amount. These precipitates

were, successively: soluble albumin,[1] precipitated by heat alone; syntonin and albumoses, precipitated by saturation with ammonium sulphate; peptones, purin bodies, amido-compounds, etc., precipitated by phosphomolybdic acid.

From an investigation of about twenty normal cases and over one hundred abnormal ones the following data have been obtained:

	Minimum.	Average or normal.	Maximum.	
Albumin . .	trace.	2–4 per ct.	7 per ct.	
Albumose . .	trace.	½–1 "	3 "	(faint cloud always remained in suspension.)
Peptone . .	5 per ct.	20–30 "	47 "	

With regard to the last line, it should be said that less than 15 per cent. is rarely found, except some hours after a meal, or unless evidence of low peptic and acid power is forthcoming. The maximum precipitate given includes albumoses, the highest precipitate found for peptone alone being 36 per cent., and, otherwise, the highest for peptone alone or albumose and peptone together—albumose never being sufficient to increase the precipitate materially—being 33 per cent.

The albumose precipitate being always scanty and inconclusive for practical purposes, I have for some time followed the suggestion of Dr. G. H. A. Clowes, and have simplified the procedure so as to precipitate soluble albumin by heat and then all further products by phosphomolybdic or phosphotungstic acid. On account of the sharp demarcation between these two precipitates, it is unnecessary to decant from the former, but the volume of the second precipitate may be read beginning at the top of the first. The weight of the second will, however, compress the first considerably, say from 2 per cent. to 1 per cent., or from 4 per cent. to 2 per cent. For comparative purposes, the first reading is taken without this compressive effect.

It is of interest to translate these readings by volume into percentages by weight. The volume of albumin represents about one-fifth as much by weight. The volume of "peptone" by phosphomolybdic or phosphotungstic acid represents about four times the bulk obtained by tannin, in those instances in which the absence of starch—which is also precipitated by tannin and which may be present when the qualitative test for erythrodextrin masks it—allows a comparison to be made. The tannin precipitate, in turn, represents about the same exaggeration of the percentage by weight as in the case of albumin. Thus, the volumetric percentage of peptone represents an exaggeration of the weight percentage by about 20. However, these statements are not intended in an accurate quantitative sense, but merely to afford a general idea of the magnification, so to speak, obtained from this method. Like other clinical methods, it

[1] In the original report this was called *acid albumin* or *syntonin*. Although after the ordinary test meal all soluble albumin has become so through the action of acid, it is not *acid albumin* in the technical sense until it becomes uncoagulable by heat.

is intended only for comparative use, and must not be interpreted in too literal a sense.

So far as I am able to learn, there are no conditions liable to be encountered in stomach contents, obtained in the usual way and examined with a fair degree of promptitude, which interfere with or notably diminish the precipitates mentioned. Obviously, if the albumin precipitate were allowed to stand for a long time in either an acid or alkaline medium, resolution would occur, but no notable diminution of bulk can occur during the test as ordinarily performed. Nor, on the other hand, is there any extraneous precipitate obtained by boiling the acid filtrate, which can add to the apparent bulk of albumin. It may be remarked here that the properly prepared filtrate is almost absolutely free from mucin.

The precipitate by phosphomolybdic or phosphotungstic acid certainly does not consist of pure peptone. It was formerly taught that gastric digestion ended with the formation of peptone, but we now know that amido-compounds—using the word in a rather loose chemical sense—are formed, as in pancreatic digestion. I have noticed that in comparing the "peptone" precipitate of the same filtrate, before and after standing at room temperature for a day or two, a considerable diminution in volume may occur, which is probably due to chemical change beyond the stage of peptones proper. If so, the volume of the "peptone" precipitate is probably not materially exaggerated by the progress of digestion beyond the nutritive stage.

The lower proteids having been already removed, the "peptone" precipitate of filtered chyme may theoretically include peptones proper, amido-derivatives of proteids, amido-acids of bile, ammonium salts, alkaloids, and purin bodies. Any considerable admixture of bile spoils the sample for any kind of systematic analysis. Moreover, bile acids would be precipitated by HCl and excluded from the investigandum, unless there existed an absence of free HCl. Ammonium salts do not interfere materially, for even a 10 per cent.—practically a saturated—solution of ammonium sulphate yields less than 1 per cent. volumetric precipitate with phosphomolybdic acid, and an amount of ammonium demonstrable by the ordinary rough tests is almost never found in chyme. Alkaloids are, of course, never present in any appreciable quantity. In my report in 1900 the statement was made that phosphomolybdic acid did not precipitate with normal urine, although a blue color was produced. This statement is incorrect, as a small (usually 1 per cent. to 4 per cent.) but perfectly distinct precipitate is produced. The experiment was repeated several times, so that the discrepancy cannot be ascribed to a single exceptional urine, and the observation is so simple that the personal equation need not be considered. Doubtless, there was some imperfection in the reagent obtained for the control experiments with urine.

I have noticed a peculiar reaction with starch. Phosphomolybdic acid does not precipitate with a solution of HCl corresponding to the ordinary maximum in gastric juice, nor with a concentrated solution of starch. When, however, phosphomolybdic acid is added to a concentrated solution of starch, also containing hydrochloric acid in gastric strength, a precipitate up to 4 per cent. by volume may be obtained. This reaction well illustrates a possible fallacy in dealing with complex mixtures of organic and inorganic substances, for, aside from mutual reactions to produce insoluble substances, which form an important part of inorganic analysis, a genuine precipitation may drag down other substances in a mechanical way, or various changes of conditions may influence the solubility of certain substances. It is obvious that the method of analysis described follows the plan of successive precipitation and removal which characterizes the "wet method" of inorganic analysis. It is equally obvious that organic substances do not interact with the same definiteness as inorganic and that the conclusions drawn cannot be so absolute. Nitrogen estimations have naturally suggested themselves as a means of gastric analysis, and have been employed in different ways by various chemists. Unfortunately, the estimation of nitrogen does not afford a clue to its source from this or that proteid or proteid-derivative, and the nitrogen percentage of albumin, albumose, and peptones in the generic sense is nearly the same, while, on the other hand, nearly or quite as great variations of nitrogen percentage may occur within each of these groups. It is theoretically possible to analyze quite accurately the various proteids of chyme. The process is, however, altogether too difficult for ordinary clinical use, and I am informed that it is impossible, even for an expert chemist, to make such an analysis with the small quantity of investigandum available —usually less than 20 c.c. of filtrate, after allowing for the ordinary acid titrations.

In order to determine how far the so-called peptone precipitate might be increased by the reaction with purin bodies, the following experiment was applied to a number of cases—about ten in all. The liquid above the strata of albumin by heat and remaining proteids, etc., by phosphomolybdic acid was decanted and the precipitates dissolved, so far as possible, by liquor potassæ. The remaining sediment was again centrifugalized and was found to amount to about 0.5 per cent. (taking the 10 c.c. as 100 per cent.) by volume of a beautiful, navy-blue pigment. I am informed by chemists that this is a reduction product of molybdenum, of unknown constitution. It is, however, probable that the potassium hydroxide redissolves other than the strictly proteid precipitates. Still, from the *a priori* probability that non-proteid precipitable substances are present in minute amount, from the experiments with urine and with starch and HCl, it seems a warrantable deduction that the so-called peptone precipitate is not exaggerated by more than 5 per cent. (taking 10 c.c. of

original filtrate as 100 per cent.), and this possible fallacy does not interfere materially with the practical value of the test.

Realizing, then, that we are employing a purely clinical and approximate method of comparing the proteolytic power of different stomachs or of the same stomach at different times, the question presents itself, What practical conclusions can be drawn from the results? In looking over my tables, it has not been possible to recognize a definite relation between the proteid precipitates and any other single object of the routine examination, such as acidity. This is by no means a condemnation of the method. If proteolysis were a mathematical function of some other measurable factor, it would not be necessary to attempt the former investigation at all.

A priori, it would seem that the albumose precipitate or this and the peptone precipitate should rise and fall with the amount of combined hydrochloric acid, but I cannot discover any such direct relationship. However, in a series of notes on gastric analysis, published in *American Medicine* in 1902–1903, I have shown the fallacies of the sodium-tungstate test for combined acidity, and that by alizarin is probably not much better. Incineration methods are not adapted to clinical study, but it is possible that a really accurate estimation of combined hydrochloric acid would show a correspondence to the proteolytic tests.

When the albumin precipitate is high and the peptone precipitate low, poor digestion is suggested. One of the reasons for abandoning the separate precipitation of albumose was that the intermediate position of this precipitate and its small amount prevented any positive deduction. It often happens, however, that there is an abundant precipitate in both or all three steps in the process. This suggests that there has been a recent acceleration in the acidifying or early stages of digestion, and certainly does not seem to indicate an impairment of digestion. On the whole, the most definite information seems to depend upon the amount of the final precipitate, which should amount to 20 per cent. to 30 per cent. Generally speaking, there is a fair correspondence between what has been alluded to as the optimum precipitates and a fairly normal acidity and ferment test. For instance, we may compare two tests made on the same case under similar conditions:

Total acidity.	Free HCl.	Combined HCl.	Albumin.	Albumose and peptone.	Rennet test.
48	22	19	trace.	8 per ct.	Weak.
90	45	29	1 per ct.	26 "	Strong.

When the investigandum is obtained late after a meal the digested proteids are low, usually about 10 per cent., whether the hydrochloric acidity is excessive or nil. Disturbances of the normal distribution of acidity in general seem to be inimical to digestion. While the alizarin test may not be reliable for the estimation of combined hydrochloric acidity, any great difference between the readings of acidity

by dimethylamidoazobenzol and alizarin indicates fermentation acidity, and if the sum of free hydrochloric and so-called combined hydrochloric acidity does not nearly equal the total, the peptonization is usually low. For instance:

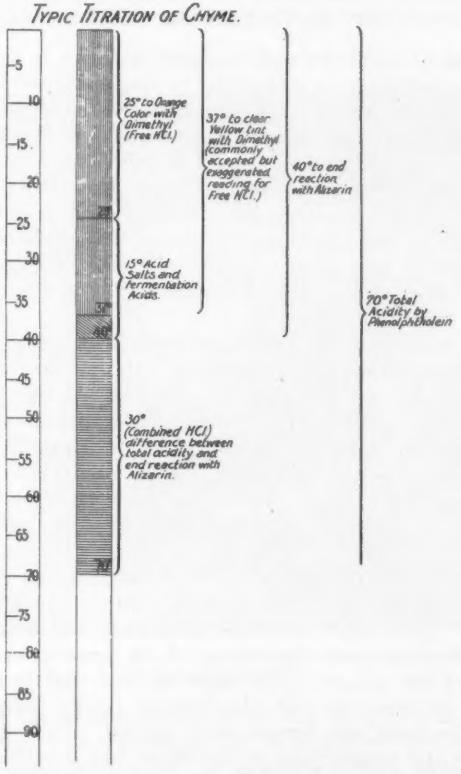
	Total.	Free HCl.	Combined HCl.	Fermentation.	Albumin.	Albumose.	Peptone.
F. G	85	15	27	85—(15+27)=43	1	trace.	10
J. B. B.	78	8	53	17	4	¼	22
G. L. S.	77	10	50	17	5	trace.	31
M.	80	34	37	9	2	.....	23
E. A. S.	78	28	33	7	trace.	.....	22
W. J. B.	70	22	23	25	½	.....	14
J. P.	89	41	25	23	4	¾	17
C.	74	10	42	22	4½	1	16½

We cannot expect a very close correspondence in such examples, although I have selected several in which the total acidity is about equal. The phenolphthalein test for total acidity is fairly sharp and accurate. The alizarin reaction is sharp, but probably not very accurate. The dimethylamidoazobenzol test for free HCl is neither. As reported in the series of notes published in *American Medicine*, 1902–1903, the tedious method of titrating without an indicator and removing a drop of the investigandum from time to time and testing it with resorcin and sugar, has convinced me that an exaggerated reading for HCl is obtained, if we note the final but sharp end reaction with dimethyl. Instead, we must take the reading when the first slight but distinct change occurs from cherry to orange. This change occurs about fifteen degrees before the end reaction occurs, but I am unable to decide the point of change within an error of five degrees. As the alizarin method of estimating combined hydrochloric acidity is merely one of subtraction, it is immaterial for our present purposes whether this test is reliable or not, but the fact remains that when there is a considerable acid factor between the dimethyl reading and that by alizarin we may anticipate a low peptonization. This point may be illustrated by the diagram on opposite page. Unfortunately, we do not understand exactly how the acid salts and fermentation acids affect the various indicators. Apparently, a free organic acid acts precisely like a mineral acid, but much less energetically, and although I am convinced that the common practice of reading free hydrochloric acidity at the end reaction with dimethyl gives an exaggerated value and leads to the diagnosis of hyperchlorhydria in many instances in which there is really euchlorhydria—perhaps temporary—we must remember that all titration methods are purely approximate.

The method of proteolysis described, though approximately quantitative, must be thought of—like the acid estimations—as the measure of a rate of progress instead of a distance covered. There is no way of measuring the absolute amount of material digested by or in the stomach. We can, of course, weigh and analyze the entire test meal before ingestion and an hour or so afterward, resorting to thorough

lavage. But we cannot be sure that some portion of the meal has not passed the pylorus undigested; on the contrary, we can be reasonably certain that considerable loss has occurred in this way.

The method described is more simple and easy and, *a priori*, more logical than those based on measuring the "left-over" digestive power. That it is crude and contains fallacies, is obvious, but all methods applied clinically to the very meagre amount of investigandum obtainable are subject to this limitation. I am rather preju-



diced in favor of the use of centrifugal volumetric estimations for various clinical purposes, believing them to be more accurate on the whole than gravimetric methods employed under the unfavorable conditions common to most clinical investigations and than most clinical adaptations of elaborate methods, such as the Kjehlaahl nitrogen determinations. Meanwhile, assistance is desired in noting fallacies and in discovering more accurate means of separating the various proteids.

THROMBOSIS OF THE MIDCEREBRAL ARTERY CAUSING APHASIA AND HEMIPLEGIA.[1]

By Charles W. Burr, M.D.,
PROFESSOR OF MENTAL DISEASES IN THE UNIVERSITY OF PENNSYLVANIA.

REMARKS ON CEREBRAL SKIAGRAPHY.

By G. E. Pfahler, M.D.

The point to which we wish to direct attention in the following report is the usefulness of skiagraphy in diagnosing cerebral disease and in locating the lesion. The importance of the method in tumor of the brain is well established. It probably will become of great value in the differential diagnosis of so-called uræmic hemiplegia, in which there is no gross organic lesion, from hemorrhage and thrombosis. It may possibly prove to be an aid in differentiating between the two last conditions by means of the different location of the shadows, hemorrhage usually affecting the striate artery, thrombosis often of the main trunk as well as its branches. The patient's history is as follows:

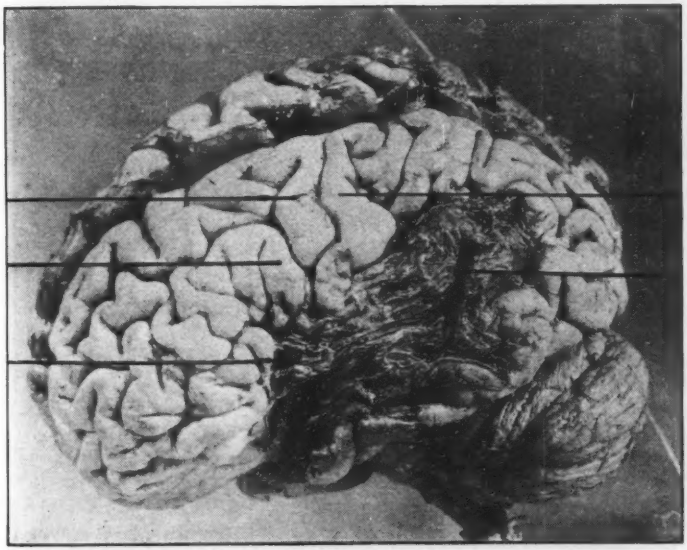
R. C., a white woman, aged sixty-seven years, was admitted to the Philadelphia Hospital in February, 1901. She had a right-sided hemiplegia and was aphasic. We learned but little of her previous history. Thirty years before her admission she suddenly lost power on the right side and became speechless. After several months sufficient power returned in the leg to enable her to walk a little, but speech never returned. Ever since the onset of the palsy epileptiform convulsions have recurred at long and irregular intervals.

When examined, the day after her admission, she could stand alone and, with the aid of a cane, walk a little. The gait was very hemiplegic. The right arm was completely and absolutely paralyzed. There was very slight palsy of the lower part of the face and none of the tongue. The right leg was slightly rigid. The right shoulder was very stiff, the forearm rigidly flexed upon the arm, but the wrist and fingers were relaxed. Passive movement of the right arm caused pain in the elbow and shoulder. The left knee-jerk was normal, the right increased. Ankle clonus and Babinski's reflex were present on the right side. There was slight wasting of the right arm from disuse, but no neurotic atrophy. Tactile sensibility could not be determined on account of the inability of speech. Sensibility to pain was certainly preserved. Her only speech was the recurrent utterance "no, no, no—no, no." This was expletive, not intellectual. It was spoken on every

[1] Read at the Pennsylvania State Medical Society, June 24, 1903.

attempt to speak, and I am sure that sometimes it was uttered unconsciously in direct consequence of some external stimulus without any willed effort. It probably, therefore, was, in the latter case, not even emotional, but purely reflex. She showed by gestures indicating their uses that she recognized the nature of familiar objects by sight, but of course she could not name them. She did not recognize written or printed words at all. She certainly recognized letters to be such and seemed to know the specific meaning of four or five. She recognized the nature and uses of familiar objects put in her left hand, but with the right hand she recognized

FIG. 1.



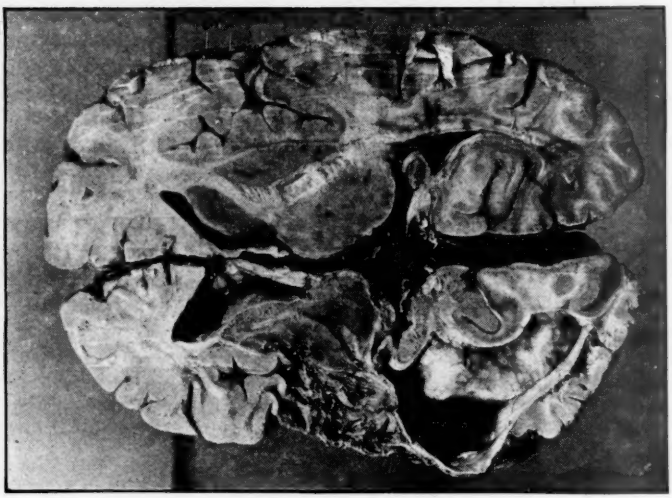
A. Dent in cyst wall. B. Ascending frontal convolution. C. Second frontal convolution. D. Third frontal convolution.

nothing. The significance of this could not be determined owing to the impossibility of discovering the condition of tactile, weight, thermal, and space sensibility. It may have been caused by a disturbance of sensibility or been the result of a true cortical tactile amnesia. She could not write at all either from dictation or copy. She was not completely word deaf. She obeyed all simple verbal commands even when great care was taken that she should not be able to guess the meaning of the order from my gestures. Complex commands requiring long sentences to give she did not understand and did not obey. She could not understand any conversation except the simplest phrases. There was however, as I have said,

a remnant of word hearing left. She was not deaf to sound. While in the hospital she had several convulsions and several attacks of unconsciousness. She had chronic nephritis and died in a uræmic attack in April, 1902.

A necropsy was made the same day. Examination revealed extensive destruction in the region of distribution of the left midcerebral artery. The destroyed area was covered over by a pseudocystic pial membrane. Fig. 1 gives a false impression in one regard, namely, the depression marked "A" is not, as it appears to be, a fissure surrounded by a convolution (the angular gyre), but merely a dent made in the cyst wall at the time the photograph was taken. The lower halves of the ascending frontal and ascending

FIG. 2.



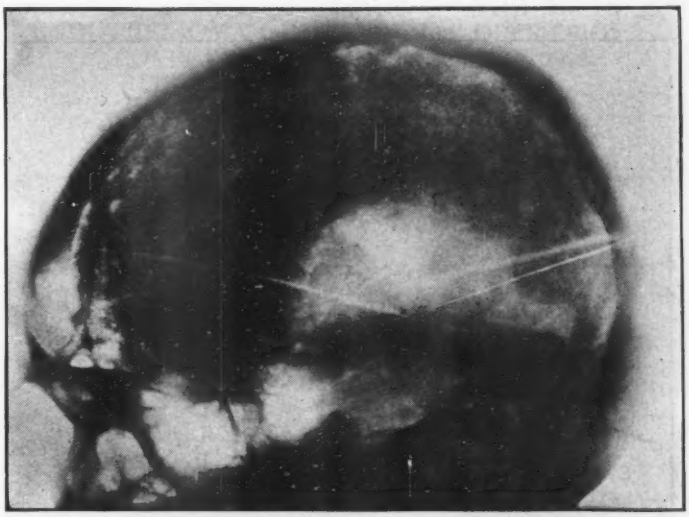
Horizontal section of brain, showing atrophy of left side.

parietal convolutions were completely destroyed; the upper halves were somewhat atrophied. Nothing remained of the island of Reil and only a small portion of Broca's convolution. The supramarginal, angular, and first temporal convolutions were absent. A part of the second temporal was also destroyed. The basal ganglia were quite a little smaller on the left than on the right, and the left internal capsule was atrophied. The anterior half of the posterior limb of the capsule was more affected than the posterior half. (Fig. 2.) The posterior horn and middle portion of the left ventricle were much enlarged and the outer wall was entirely lateral membranous, the cortex and underlying white matter being entirely

destroyed. It is remarkable that the patient was not completely word deaf. The amount of speech hearing she possessed must have been due to the education and vicarious action of the right temporo-sphenoidal lobe.

The case is interesting in many ways, for example, as regards aphasia and differences in vascular distribution, for it is probable that there is quite a variation in the arterial distribution in different brains, but I wish to use it here simply as showing the possibilities of skiagraphy in the hands of an expert such as my friend Dr. Pfahler.

FIG. 3.



Skiagraph showing the outline of the skull, the frontal sinuses, the orbits, the base of the skull. The middle meningeal artery, the division between the cerebrum and the cerebellum, and the light area in the cerebrum corresponding exactly to the area of softening.

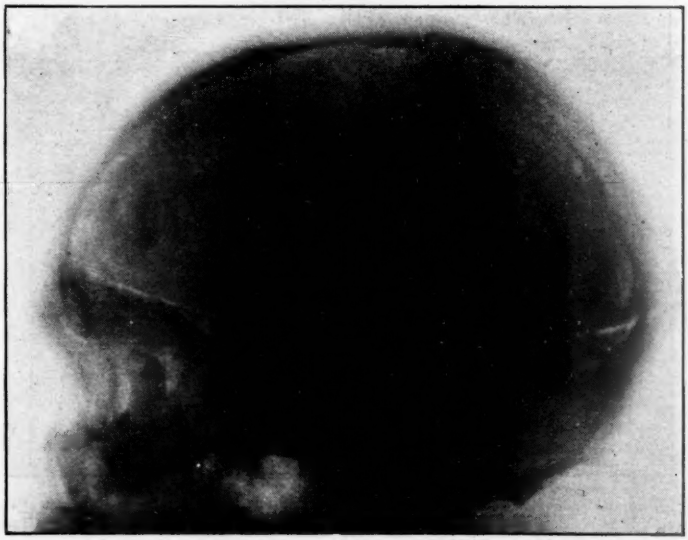
Remarks on Cerebral Skiagraphy. By G. E. Pfahler, M.D.

At the February meeting of the College of Physicians of Philadelphia,[1] I demonstrated, in connection with the case reported by Dr. Mills, that brain tumors can be skiagraphed. Some of these skiagraphs showed the absence of brain tissue, others a disturbance of brain tissue without any actual absence. Basing my opinion upon these facts I believed that an area of softening of the brain could be shown. My first opportunity to test this point developed at the autopsy in Dr. Burr's case just reported. The brain was replaced in the skull and an attempt made to photograph it by

[1] Philadelphia Medical Journal, February 8, 1902.

means of the Roentgen rays. I first made a negative of the affected and then one of the opposite side, because I believed that possibly the normal side could be used for comparison with the diseased. The present case demonstrates, however, that this cannot be relied upon, for the lesion was shown upon both negatives, but with much more definite outline on that of the affected side. In studying a skiagraph it is important to recognize the shadows of normal structures first. If these are not shown well, abnormal shadows must be accepted with doubt. If, however, normal shadows are clear and definite, I believe that abnormal shadows will be of great value in making a diagnosis.

FIG. 4.



Skiagraph showing a normal brain in a skull prepared for experiment, also shows the outline of the skull, the two tables of the skull, the frontal sinus, which is unusually small, the sphenoidal and mastoid cells, and the external auditory meatus. The division between the cerebrum and the cerebellum may also be seen.

In the skiagraph which I show of the affected side may be noticed the following normal structures: The outline of the skull, the orbits, the ethmoidal and sphenoidal cells, the sella turcica, the external auditory meatus, the groove of the middle meningeal artery, the division between the cerebrum and the cerebellum, and the peculiar striations which probably correspond to the convolutions of the cerebellum. Irregular shadows are also seen which are suggestive of the convolutions of the brain.

Above the cerebellum and petrous portion of the temporal bone may be seen the light area which corresponds to the outline of the

area of degeneration. A light space is seen above the sella turcica which shows where the brain tissue had not been properly replaced. The saw cuts may also be seen. (Normal brain, Fig. 4.)

From an experience in fifty-five brain examinations I am convinced that the Roentgen rays will be of considerable value in the diagnosis of cerebral lesions. I believe that we shall be able to diagnose most large lesions, such as new-growths, softening, hemorrhage, and abscess.

REPORT OF A CASE OF TUMOR OF THE BRAIN, AN ENDOTHELIOMA OF THE DURA; OPERATION; RECOVERY; DEATH IN 108 DAYS FROM RECURRENCE OF THE DISEASE.

By William J. Taylor, M.D.,

of Philadelphia,

Attending Surgeon to the Orthopedic Hospital and Infirmary for Nervous Diseases and to St. Agnes' Hospital; Consulting Surgeon to the West Philadelphia Hospital for Women.

A boy, aged fifteen years, born in America, of Russian-Jewish parentage, was seen first with Dr. Theodore Sprissler on January 25, 1903.

He had been perfectly well until ten weeks before, when he misbehaved at school, and his teacher, becoming angry, seized him by the neck and bumped the right side of his head against a wall. He came home and immediately complained of headache. Shortly after this, still complaining of headache, he was taken to see Dr. Theodore Sprissler, who examined his head carefully and could find no evidence whatever upon the scalp of any violence, as there was no abrasion, no bruise, nor swelling. He did, however, have some slight fever—a little over 100° F.—and Dr. Sprissler sent him home and to bed, fearing that he might be contracting typhoid fever, but he did not think that the knock on the head had anything to do with his condition. This fever soon passed away.

He did not see him again for some little time, and then only for headache, which the boy always complained of as being localized in his right temporal region. Of late this headache had become more marked and there had been some vomiting, but there were periods of entire freedom from pain.

Thinking the headache might be due to some ocular defect, he was sent to Dr. F. M. Perkins on January 20, 1903, who made this record:

"*Examination.* No external variation from normal appearances. Vision normal. Pupils respond to light, convergence, and accommodation. Neither eye goes out under covering hand; has full

vision with either eye and reads 0.5 type. Instilled homatropine for ophthalmoscopic examination with following results:

"Right eye: media clear, H. 2 D.; veins and arteries slightly tortuous, but vessel contours nowhere blurred. No retinal or choroidal changes. L. E.: the same conditions exist as in right eye.

"*January* 21. Atropine sulphate 0.01 gives in either eye H. 2 D. Headaches still persist. Ophthalmic examination gives same appearances as on January 20th.

"27*th.* Patient was seen at office January 22d and 25th, and no changes in eye-ground appearances of January 20th noted, but on this date, at an examination made at the patient's home, the following was noted:

"Right eye: pressure neuritis; full, tortuous veins; lymph spaces full and at places contours of vessels almost lost; edges of disk hazy. Left eye: same conditions as in other eye, except in less degree."

The boy would have periods of headache, at other times was perfectly free from it, and during the time of freedom from pain ran around and played like other children, and attended school for five or six successive days before Dr. Perkins' first examination. These paroxysms of headaches were of such a character that at times he was thought to be shamming, but soon vomiting occurred, and of a cerebral type.

In view of this condition, he suggested to Dr. Sprissler that I see the boy.

Now there was a very slight swelling over the squamous portion of the temporal bone, about the point of the insertion of the temporal muscle, and this was the spot at which he complained of his intensest pain, and it was somewhat tender on pressure.

When I saw him, on the 25th, the boy had been losing flesh, but there were no palsies. His station was perfectly good, but he complained of intense and increasing headaches, which were now almost constant, with occasional vomiting. I advised that he be seen by Dr. C. W. Burr, and also to increase the dose of potassium iodide, which he had been taking. The boy was evidently getting much worse, and on the 28th I saw him again, in consultation with Drs. Burr and Sprissler. We now were fully convinced that we had to do with a cerebral growth rapidly progressing. The symptoms had all increased; he had the most typical cerebral vomiting I have ever seen, and this occurred repeatedly while we were examining him. The slight enlargement on the right side of the skull had increased very materially and was extremely tender on pressure.

Medical Examination by Dr. Burr.

"I saw the boy for the first time on January 28th. On the right side of the head above the ear was a swelling about as large as a fifty-cent piece and circular in outline. It was painful and sensitive on

pressure. There was no palsy of either arm or leg, or of the face. He used the left arm a little awkwardly. Sensibility to touch was normal on the face, arms, and legs, and there was no astereognosis. The left knee-jerk was a little diminished; the right normal. There was no muscular rigidity, nor ankle clonus. Stroking the sole on either side caused quick and rapid extension of the toes. He could walk a little, but staggered much, and attempts at walking caused vomiting. I was not sure whether the staggering was due to ataxia or to weakness and the violent head pain. Several times during the examination he had attacks of cerebral vomiting. Speech was normal. His mental state was good. He did not like to talk much on account of the violent headache, but there was no clouding of consciousness nor was he mentally dull or silly. He answered all questions intelligently."

We believed the condition to be due to a growth of the skull, most likely an osteosarcoma, and that it was growing downward and producing pressure upon the brain, and not likely to be a growth of the brain itself.

As he was growing so much worse and so rapidly, we all advised that he should be taken to St. Agnes' Hospital at once, and that his skull be opened the next day.

On Thursday, January 29th, four days after he was first seen, I operated. His condition was growing rapidly worse; evidence of pressure had distinctly increased, the pulse was 56, the temperature was normal, and he complained of intense pain in his head. His head was shaved, washed, and the scalp thoroughly disinfected, and, in the presence of Drs. Burr, Perkins, Sprissler, and a number of others connected with the hospital, I made a large flap over the temporal region and turned down the scalp. The flap, which was oval, was three and one-half inches across at its widest point. I found that a growth had eroded the skull and was attached to the temporal fascia and under portion of the scalp. This diseased portion I dissected away. I now with a chisel made a circular opening in the skull and lifted out a button of bone, two inches in diameter, the centre of which was the perforated portion of the skull. This was very vascular and evidently had undergone in almost its entire extent changes which, from macroscopic appearances, resembled sarcoma. In paring off the underlying growth I thought at first that I had opened into a large infiltrating growth of the brain. This was very dense and contained numerous fibrous bands. I next took a rongeur forceps and cut away the bone in front, at the back, and particularly toward the zygoma, and at last reached the limit of the growth. In working around the edges of the growth I found it was outside of the dura. The circumference of the dura was intact, but in the centre it had a base of about one inch, which was adherent. I now cut the dura completely around the growth and found a large tumor growing from the dura and projecting into the tissues of the

brain, but entirely free from attachments in every direction. This I shelled out without much hemorrhage. I used hot water to control the bleeding in the scalp and in the bone, as well as Horsley's putty, then packed lightly with iodoform gauze and closed the scalp.

He reacted well from the shock of operation and loss of blood, and in forty-eight hours the packing was removed. His condition was now most satisfactory: headache had ceased almost at once, his temperature had been good, but at the end of seventy-two hours there was evidence of a fungus cerebri. There had been comparatively little bleeding, but tremendous weeping of cerebro-spinal fluid, necessitating frequent dressing.

I did not believe at the time of operation that all of the diseased bone and dura had been removed, but all was taken away which had the appearance of disease. His condition was alarming, and I feared that he would die on the table from hemorrhage. I believed there would be a speedy recurrence of the growth.

Every other case of dural tumor that I have seen, with one exception, has died from hemorrhage either at the time of operation or within the first twelve hours. The exception that I mention was a fibroma of the dura, removed by Dr. Keen in 1887. I have seen a number of other cases, and all have died from hemorrhage.

February 3*d*. Dr. Perkins made this note: "Ophthalmoscopic examination (in bed with candle-light) shows in each eye distinctly made out contours of all vessels; no neuritis present."

By February 13th, or in fifteen days, he was up and about the ward. The wound had healed throughout, except at one small place, where there had been packing, and from this there still was a discharge of cerebrospinal fluid, but this was gradually diminishing each day, and ceased on the 15th. He had absolutely no pain nor tenderness, nor any interference with his eyesight, nor any evidence whatever of trouble with his brain.

February 21st. Dr. Perkins made this note: "Examination with student lamp at St. Agnes, boy sitting in chair in the dark room, conditions for examination thoroughly satisfactory. Right eye: no vessel tortuosities or dilatation; macular region is the seat of fine, silvery bands; otherwise fundus normal. Left eye: same ophthalmoscopic appearances as in other eye."

On March 6th, after an absolutely uninterrupted recovery, he returned to his home with the wound completely healed, except, possibly at one place, where there was a line of granulation about one-half inch long by one-eighth of an inch wide. The eye-grounds were normal and he seemed to be perfectly well.

On March 12th he complained of a stiffness in the neck and inability to open the mouth wide, but this he had at the hospital, and was probably due to the irritation of the temporal muscles. He had no pain, headache, nor any symptoms of intracranial pressure, but there was certainly a greater amount of bulging at the site of the

wound than before. The whole of the flap was pushed out and there seemed to be a rather hard, nodular swelling beneath the scalp.

I believed the growth returning and sent him to Dr. Burr for his examination and then to Dr. Perkins.

March 12th. Boy seen at his office by Dr. Perkins, who noted: "Pupils responsive to light, convergence, and accommodation. Neither eye out under cover; red Maddox rod, with rotary prism, with small electric light as object, gives at 20 cm.: exophoria, 0 to 2 degrees; hyperphoria, 0; and at six metres esophora, 1 degree; hyperphoria, 0. Right eye vision, 6/6; left eye, 6/6; no lenses used. Instilled homatropine for ophthalmoscopic examination, which gives the following findings: either eye media clear, and no pathological fundus appearances. The silvery macular bands noted on February 21st have entirely disappeared."

On March 16th, as there was distinct recurrence and no further operative measures could be undertaken, Dr. S. Mason McCollin began the use of the *x*-rays; but in two days there had been a rapid increase in the size of the growth, and he had slight headache, and his father noticed for the first time a slight discharge, which came from a small spot about one quarter of an inch in diameter at the upper anterior angle of the wound, and here and there at several spots over the surface of the projection were small points, which evidently would break down in the course of a few days.

I had never seen such a rapidly progressing growth.

By March 22d he had grown so much worse and his weakness had increased to such an extent that he was no longer able to go back and forth to Dr. McCollin's office, and he therefore entered St. Agnes' Hospital for further treatment by the *x*-rays. The growth had enlarged very much, and his general condition was weaker; he was pale, complained of pain in his head, and slept badly.

By March 31st the growth had increased somewhat in size, although this could only be estimated. He had had no headaches for a week, and this freedom must be attributed, I think, to the *x*-rays. He complained of a great deal of stiffness and pain in the neck, and of some numbness in the thumb and forefinger of the left hand, and stated that he could not move his thumb freely, although, when his attention was directed to it, it seemed to me that he could do so.

March 26th. Ophthalmoscopic examination made by Dr. Perkins showed in either eye slight vessel tortuosity, otherwise normal fundus. Red Maddox and rotary prism gave no muscle imbalance; and on April 2d: "In either eye the presence of undoubted neuritis, with swollen disks; the edges of the nerve entrance obscured, the vessel contour at places (even on general retinal level) being obscured for small areas. There was no evidence of enormous lymph extravasation or extensive hydraulic pressure, as was present at the commencement of the case—*i. e.*, before operation—but the eye-

ground appearance was indicative of small encroachments on the calibres of the efferent vessels; presumably, therefore, commencing basilar interference. An examination made about four days before showed only vessel tortuosity, but no nerve head uplift above general retinal level. The Abney pellet test shows no central scotomata. There was no essential difference between the fundus appearances of either eye."

On April 13th he was taken to his home. He had now total paralysis of his left arm and hand, some paresis of his right hand; his speech was becoming impaired; he was very somnolent, sleeping almost all of the time, but he did not complain of much pain. Shortly after this he was placed under the care of another surgeon, who ligated the external carotid artery, evidently attempting to produce starvation of the growth by cutting off the blood supply. In this he was unsuccessful, as the boy died on May 17th, 108 days from the date of the removal of the tumor from the brain. No post-mortem examination was made by the physician then in attendance, and I did not learn of his death until some days after the funeral, and too late to make an attempt to procure one.

Remarks by Dr. Burr.

"I saw him again two days ofter operation. His condition was excellent. He was free from headache, bright and cheerful. There was neither anæsthesia nor palsy of either arm or leg. On March 12th he walked to my office and still was in excellent condition, except for a slight rheumatic wryneck, which passed away in a few days. The tumor had, however, already begun to grow again, and I advised against operating a second time. When I first saw him the diagnosis of tumor of the brain was not difficult, but I was in error as to its nature. I thought it was most probably an osteosarcoma; it was an endothelioma.

"There is not the slightest doubt that Dr. Taylor's operation not only prolonged the boy's life, but gave him a period of entire relief from very serious symptoms. Had he not been operated on I am sure he would have died a few days after my first examination.

"The tumor, of course, affected only the prefrontal lobe. It pushed aside but did not penetrate the brain mass; it was not an infiltrating growth. Whatever relation there may be between the prefrontal lobes and mental processes, this case proves that there may be serious and rapidly increasing pressure on the right prefrontal lobe without any mental symptoms whatever."

Pathological Report by Dr. D. J. McCarthy.

"Sections were cut from the tumor mass, the dura, and the bone. Sections of the dura and its free edges showed the connective-tissue nuclei larger than normal, but there was no evidence of tumor-cell

infiltration. Sections of bone over the tumor showed a sclerated condition of the bone with absence of diploë, but there was no evidence of a malignant condition of the bone tissue. The sections from the tumor, and also sections cut through both the tumor and the dura, showed a tumor formation evidently starting from the meninges. The cells were arranged in rows following a racemose arrangement, and were in close contact with the interstitial tissue. Two types of cell were present: a large cell with small nucleus and relatively larger quantity of cell body, and a small round cell in the centre of the cell nests. The accumulations of cells in the dura between the bands of connective tissue gave somewhat the appearance of scirrhus, but the racemose type of infiltration following the lymph paths and the arrangement and type of cell lead us to make a diagnosis of endothelioma starting from the meninges."

A REPORT OF FIVE CASES OF TUMOR OF THE BRAIN, WITH OPERATION.[1]

By William G. Spiller, M.D.,
Associate Professor of Neurology and Professor of Neuropathology in the University of Pennsylvania.

During my recent term of service at the University Hospital five cases of tumor, the growths being situated at different parts of the brain, were under my care, and in all operation was done by Dr. C. H. Frazier.

The first case was one of multiple sarcomatosis, and has been reported already in The American Journal of the Medical Sciences, July, 1903. A tumor was believed to be in the cerebellopontile angle, and it was found at this place. Multiple sarcomata of the central nervous system were not suspected before the operation, because they did not cause symptoms. I have already discussed this case and shown that symptoms of these numerous growths were absent because the tumors were so soft they caused no pressure and little or no destruction of tissue. This case is referred to here in connection with the other four, because all five cases occurred within a few months and in the same service.

Case II. *Tumor of the motor area, correctly localized and operated upon, with much improvement in the patient's condition during a period of seven weeks; return of the growth, with fatal termination.*—G. K. was referred to me by Dr. B. Kohn, April 21, 1903, with the following notes:

The patient denied having contracted syphilis, but said he had had gonorrhœa. He had used alcohol formerly to excess. He had had

[1] Read before the College of Physicians of Philadelphia, December 2, 1903.

headache for several years, but the pain had been growing worse since last summer, and had been especially severe during the previous two weeks. The pain was more or less over the whole head, but was more on the left side, especially in the forehead, and was more severe at night, and was not constant. He had noticed weakness in the right arm and hand for about two months. Since December, 1902, he had had convulsions—at first once a week, but lately not so often, and had had none during the previous two weeks. He always knew when they were coming on by a twitching in the right eye for about five minutes before the spasms developed. The attack began with a peculiar sound in the throat, the eyeballs then rolled about, and the right arm and hand became implicated in the convulsive movements. Sometimes the right lower limb was affected, but never the left side. Consciousness was not lost, and the man did not fall into sleep after the convulsions. The attacks occurred usually when the man was awake, but several times while he was asleep. The convulsions lasted about three minutes; sometimes longer. The patient had noticed for about a month that he had difficulty in speech, but his family had observed the indistinctness of speech only for about five to seven days. The disturbance of speech was purely motor in type.

The right eye had been weeping for three weeks. He had noticed dimness of vision, especially in the right eye, for some time. Mentality was sluggish and memory was poor. He had no delusions, no nausea, no vomiting, no incontinence of urine, no paræsthesia, and no pain except in the head.

A partial paralysis of the right side of the face had not been noticed by the family. The nasolabial groove was less distinct on the right side. He could not whistle well, and could not draw up the right corner of the mouth so well as the left. He was able to wrinkle the forehead and close the eyelids perfectly. The tongue when protruded deviated to the right. The pupils were equal, and the light response was preserved, but was slow on the right side. Local tenderness of the scalp to percussion was not obtained. The patellar reflexes were increased. Station was very poor, and the man was not able to stand without support. The right arm and hand were very weak and the grasp was poor.

Dr. Kohn said that he had noticed an appreciable increase in the aphasia and loss of power since he first saw the patient, one week previous. He could then stand and walk without support.

My notes, made April 25th, are as follows:

The patient is unable to give his history because of partial motor aphasia. He can speak some words and give his name. When asked his age he says fifty-two. He is unable to speak an entire sentence correctly, and has paraphasia. He understands all that is said to him. He says that he has severe headache, that it is constant, and places his hands over the forehead and over the occipital region. He seems to be unable to read at all. He wrinkles his forehead

equally well on the two sides; shuts his eyes tightly and equally well on both sides. The right side of the face in the lower distribution of the seventh nerve is paretic. The tongue when protruded deviates a little to the right. No tenderness is felt on percussion of the scalp.

The right upper limb is very paretic. The grasp of the right hand is very feeble. The biceps tendon reflex on each side is about normal; the triceps tendon reflex is not obtained on either side. Sensation for touch and pain is preserved in the right upper limb. The muscles of the right forearm and hand are more wasted than those of the left.

The right lower limb is very paretic. He is able to flex the limb at the hip and knee. The patellar reflex is prompter on the left side than on the right, and yet it is a little below normal on the left side. Ankle clonus is not present on either side. The Achilles jerk also is weaker on the right side and about normal on the left side. The Babinski reflex is not obtained on either side, the toes being flexed on irritation of the sole of the foot. Sensation for touch and pain is normal in the lower limbs. In walking he drags the right lower limb and allows the right upper limb to hang at the side of his body.

April 27th. Percussion of the head does not give positive results. He has no loss of stereognostic perception. He denies positively a syphilitic infection and says he has not had dizziness.

The report of the ophthalmologic examination, April 25th, in Dr. de Schweinitz's service, by Dr. E. A. Shumway, is as follows: Vision, R. E., 6/150; L. E., 3/150. Pupils: reaction very prompt. Muscle balance: rotation of eyeballs seems unlimited in all directions. Eye-grounds: the left eye shows some fulness of central lymph sheaths; the lower inner margins of the nerve are slightly veiled, but there is no other lesion. The right eye has entirely normal eye-ground. Hypermetropia of about 5 D. in each eye. Impossible to obtain fields on account of mental condition. Visual acuity, for the same reason, very uncertain.

The report of the urinary examination, made April 29th, was cloudy; alkaline; specific gravity, 1024; albumin, a trace; sugar negative; phosphates; few epithelial cells and leukocytes.

My notes, made April 30th, are as follows: The man's account of himself is reliable, and he says positively that his convulsions have been confined to the right side of his face and right upper limb, and that the right lower limb has not been affected. The motor aphasia to-day is much greater than at any time since he has been in the hospital. The right patellar reflex is a little below normal, and the left is about normal. Bakinski's reflex is absent on each side, as on each side the toes are distinctly flexed.

On May 1st I noted that the motor aphasia seemed to be more pronounced. The right patellar reflex was about normal, and there seemed to be a slight indication of the Babinski reflex on the right side—*i. e.*, the smaller toes on the right side were extended two or three times in repeated attempts to obtain this reflex, but the big

toe was not moved. When a board containing movable letters was shown to the patient he was able to pick out six or seven letters correctly on command, and he, therefore, was not letter-blind. He said he had had very little headache on the right side of the head and that his headache had been especially severe in the left frontal region.

Dr. de Schweinitz examined the eyes on this date, and reported that the condition in the left eye-ground could not be considered positively a beginning choked disk, but that it was suggestive, and within six months choked disk might be pronounced.

The patient was agraphic.

A diagnosis of tumor of the lower left motor area was made. It was supposed to affect Broca's area by pressure, or to invade it slightly, inasmuch as the motor aphasia was incomplete. The operation was done May 2, 1903, and a tumor was found in the opening of the skull, and was removed. Microscopic examination showed it to be a small spindle-cell sarcoma.

On May 5th, three days after the operation, my notes were as follows: The man can reply to questions, but still has much motor aphasia, and more than he had before the operation. The paresis in the lower distribution of the right seventh nerve and in the right upper and lower limbs is nearly the same as before the operation. He has no word-deafness. His general health is good, and he is very cheerful. The patellar reflex on each side is a little below normal. Ankle clonus is not present on either side. Achilles-tendon reflex is about normal on each side. Babinski's reflex is not present on either side, and the toes are distinctly flexed. The biceps tendon, triceps tendon, and wrist reflexes are much diminished on each side. Stereognostic perception in the right hand is much impaired; but this may be the result of motor weakness.

By the end of May the man was able to be out of bed, and walked about the ward without assistance. He improved steadily, the right hemiparesis almost disappeared, his speech improved, his headache ceased, his cheerfulness was very marked, and he seemed to be almost entirely well. On June 20th he had a severe convulsion, involving the whole right side of the body, and he became paralyzed on the right side, but he soon regained some power in the paralyzed limbs. About July 7th signs of right-sided pneumonia developed. By July 16th the right upper and lower limbs had become completely paralyzed and speech was much affected.

July 25th. He has great difficulty in swallowing, and is completely paralyzed in the right upper and lower limbs. He can say only a few words, and these indistinctly. The biceps and triceps tendon jerks on the right side are a little prompter than normal. The patellar reflex is about normal on the left side, but a little diminished on the right side. Ankle clonus and Babinski's reflex are not present on either side. Stereognostic perception and sense of position cannot

be determined, because of the difficulty in getting the man to respond. Sensation for pain is present in all parts of the body. The face is very slightly affected on the right side, and the tongue is protruded straight.

The man's general condition did not permit a second operation. He died July 26th with signs of pneumonia; but as the lungs could not be examined at the necropsy, we were in doubt whether he had pneumonia or a tumor of the lung.

A necropsy was obtained, but permission was given for removal of only the brain and spinal cord. A tumor was found in the posterior part of the left second frontal convolution, extending into the middle of the precentral convolution and the upper part of Broca's area. The growth was infiltrating and at no part sharply defined from the surrounding tissue. It was, as already said, a small spindle-cell sarcoma. A small tumor about the size of a pea was found also on the right sixth cervical anterior root.

This case was seen in consultation by Dr. Mills, and he was also present at the operation.

CASE III. *Subcortical tumor, outer edge of tumor 1.5 cm. below the surface of the brain and within the white matter. Correctly localized as regards the portion of the brain affected, but not found at the operation because of its deep situation within the substance of the brain.*—T. S., a male, aged forty-seven years, was referred to me by Dr. L. J. Burns, April 27, 1903.

The man said he had contracted syphilis twenty-eight years previous. He had had a chancre, followed by sore throat and alopecia. He was married and had eight children living. His wife said that most of them were unhealthy and were anæmic. The wife had had four miscarriages. The man had had constant general headache during many years, but had had what he called "painful headache," confined to the left side of his face and head, during the last five years. He had paralysis of the right internal rectus; but this, he said, had been present for eight years. Since February 22, 1903, he had had convulsions, confined to the left side of the face and left upper limb. The convulsions always began in the lower part of the face, with a drawing sensation; then the jaws became locked, and the spasm extended to the upper distribution of the left seventh nerve. After the spasm in the face had reached its height, twitching of the left thumb was observed, and sometimes the left hand was forcibly rotated inward at the wrist. The left lower limb was never implicated in the convulsion. He had not lost consciousness more than once. The attacks lasted about three minutes. He had had as many as three or five in one day. When the attacks occurred he was unable to speak. He had attacks in which the speech became thick and convulsions did not occur. The warning was always a creeping sensation in the left lower jaw. He did not have nausea, vomiting, or dizziness. He complained of general weakness, but there was no

objective weakness detectable except in the lower part of the left side of the face. The biceps tendon and triceps tendon and wrist reflexes of the upper limbs were about normal. The patellar reflex was almost normal on each side. The Achilles jerk was prompt on each side, but a little more so on the left side. Ankle clonus and the Babinski reflex were not obtained on either side. The stereognostic perception was good in each hand. He had complained of a sensation of itching for years. His speech had been getting thicker during the previous two weeks. He had no tenderness on percussion of the scalp.

An examination of the eyes by Dr. W. C. Posey, April 28, 1903, gave the following results:

O. D. inward motion abolished beyond the median line. Downward motion extremely limited, even down and out. External motion fully preserved. Upward motion lost. O. D. does not react to light or in accommodation. O. S. does react to light, but slowly in accommodation. Disks somewhat gray in their deeper layers. Vision: O. D. 5/12??; O. S. 5/5??

The man was admitted to the University Hospital, and while there a convulsive attack was seen by Dr. Willetts. It began with a creeping sensation in the left lower jaw; this was followed by twitching of the left platysma and of the left angle of the mouth. The entire left side of the face was drawn up, and the spasm was tonic. Flexion of the left thumb also was observed.

The report of the ophthalmic examination by Dr. E. A. Shumway, May 26, 1903, was as follows:

Ophthalmic diagnosis: Paralysis of third nerve O. D.; paresis of fourth nerve. Partial retention of motion of eyelid; gray degeneration of optic nerves; sheaths full.

Vision: R. E., 6/12??; L. E., 6/7.5? A. R. E. 2 D., p.p. 18 cm.; A. L. E. 0.75, p.p. 22 cm.

Pupils: O. D. pupil dilates to 7 mm. No response of iris to light or in accommodation. O. S. pupils responds sluggishly to both light and accommodation. O. D. lid droops slightly; movement inward entirely abolished; secondary contracture of external rectus, so that eye can hardly be brought to median line. Downward and upward motion lost, except slight down and out (fourth). O. S. movement good.

Eyegrounds: Media transparent; nerves show decided fulness of perivascular lymph sheaths; gray atrophy of nerve.

Dr. Harland reported that there was no involvement of the larynx, but the soft palate and pharyngeal constrictors (right side) seemed partially paralyzed.

On June 5, 1903, another examination was made. The tongue was protruded straight, and showed no tremor and no atrophy. The nasolabial fold on the right side was more distinct than on the left side. When the mouth was opened the teeth were not shown as

distinctly on the left side as on the right. The patient could not draw up the left corner of the mouth alone at all, but could draw up the right corner.

Resistance to passive movements in the left upper limb was possibly not so good as in the right. The grip of the left hand was weaker than that of the right, and the left thumb was especially weak. The biceps tendon, triceps tendon, and wrist reflexes were about normal in each upper limb.

Resistance to passive movements in the lower limbs was about equal on the two sides. The patellar reflex was prompt on each side and equal on the two sides. The Achilles jerks were present and normal. Flexion of the toes occurred on irritation of the sole of the foot.

The left thumb felt numb, and the sense of position in the left thumb was much impaired, and the thumb was distinctly weak in resisting passive movements. Tactile and pain sensations were impaired in the left upper limb, and stereognostic perception was affected in the left hand. He called a dollar fifty cents, a twenty-five-cent piece a nickel. No impairment of stereognostic perception was detected in the right hand. Sensation for touch, pain, and temperature was not so distinct in the lower part of the left side of the face as in the right side. He called a pinprick sometimes a touch. The sensation of the upper part of the left side of the face was normal. He felt a pinprick less on the left side of the tongue, left side of the mouth and nose, and complained of a numb sensation in the lower part of the left side of the face like that in the left thumb.

Gait and station were normal, even with eyes shut.

A note was made that until the last two or three weeks his convulsions had always commenced in the lower left side of the face, and from here had extended to the neck, forehead, and eyeballs. Within the past two or three weeks, in five or six attacks, the convulsions had commenced in the thumb of the left hand, and had not extended farther than the wrist.

While under my care he had received mercurial inunctions and iodide of potassium until gastric symptoms developed.

A diagnosis of tumor of the right lower parietal and motor areas was made, because of the impairment of sensation in the lower left side of the face and in the left upper limb, and because of the impairment of stereognostic perception and sense of position in the left hand. The left lower limb was so little affected that the lesion was not believed to be high in the cerebral hemisphere nor to implicate the motor fibres of the lower limb in their passage to the internal capsule. Because of the convulsive movements of the left side of the face and of the left hand the tumor was believed to be cortical. An operation was performed by Dr. Frazier June 5, 1903; but, although a large opening was made, no lesion sufficiently intense to explain the symptoms was found.

An examination made June 23d, eighteen days after the operation, showed that the left upper limb was almost completely paralyzed. He could raise the left hand a little from the trunk while in bed. The grasp of this hand was very feeble. He could flex the left forearm slightly on the arm. The left upper limb was very flaccid. The biceps tendon and triceps tendon reflexes on the left side were a little exaggerated. The left lower limb was moved voluntarily and freely. The lower distribution of the left facial nerve was completely paralyzed, but the upper distribution was only slightly affected. The intelligence was good. The right side of the body was not affected.

The man had convulsions after the operation, and one of these was witnessed by Dr. C. K. Mills and myself, but the dictated notes were lost. My recollection is that they were typically Jacksonian in type and were on the left side.

Dr. de Schweinitz examined the eyes July 6th, and reported: O. D., oculomotor palsy; gray disk, with distention of the central lymph sheath, no neuritis. O. S., external muscles apparently normal; no neuritis.

He was examined on July 8th by Dr. Frazier and myself. The mental condition was bad. He did not recognize anyone. He did not reply intelligently to questions. The right pupil was much larger than the left. He had become emaciated since the operation. The left upper and lower limbs were completely paralyzed. When the left limbs were stuck with a pin they were not moved; but the movements of the right limbs when the left limbs were irritated showed that the pain sensation was preserved in the latter. The left side of the face was only partially paralyzed. We could not determine by sticking the face with a pin whether the upper distribution of the left seventh nerve was affected or not. The left limbs were flaccid. The patellar and Achilles tendon reflexes were diminished on each side equally, but were not lost. The biceps tendon and triceps tendon reflexes were also much impaired.

On July 9th Cheyne-Stokes breathing was observed, and the man was unconscious. He died on the afternoon of July 9th.

We had hoped to have a second operation. I felt sure that a lesion must be present in the area previously exposed, but the man's general condition was such that we could not feel justified in attempting another operation, especially as a very careful examination of the brain had been made at the first examination.

At the necropsy a tumor was found beneath the cortex, its central portion being below the right middle motor area. Its outer border was 1.5 cm. below the surface of the brain. The lower portion of the tumor was softened. The growth extended downward only as far as the upper level of the caudate nucleus, and at no place did it extend to the cortex. A line drawn across the brain from the fissure of Rolando would pass directly through the centre of the tumor. In

transverse direction the tumor measured 4 cm., and from before backward 5 cm. Microscopic examination showed it to be a mixed sarcoma, consisting of round and small spindle cells.

CASE IV. *Multiple tuberculous tumors (méningite en plaque) of the parietal lobe, correctly localized and exposed at operation; removal of growths impossible.*—F. F. was referred to me May 26, 1903, by Dr. Theodore B. Appel, of Lancaster, Pa., with the following notes:

The patient, a white man, aged thirty-one years, had been married some years, and had no children. The family history was obscure. The mother was alive and well. F. was splendidly developed physically, and had never been sick before the summer of 1898, when he was taken ill in Florida while serving as a volunteer, and was sent North. He was confined for six weeks in a Philadelphia hospital with typhoid fever and malaria. He recovered completely, and became a barkeeper in Lancaster. He acquired the reputation of being able to drink more and mix his drinks more than any man of his age. About July 1, 1902, he was taken ill with what his physician diagnosed as typhoid fever. He had a low fever for twelve weeks, never reaching 101° F., not accompanied by headache, intestinal disturbance, nor a great amount of depression. He was never the same man after this attack, though he went back to his work and returned to his habits as regards alcohol. He had been free sexually, but denied having contracted any venereal disease. After working for four weeks he was confined to his bed for five days with an attack of influenza. This was followed by recurrent headaches, becoming more and more severe, and both frontal and occipital. These headaches occurred every two or three days and lasted about twelve hours. The day following he usually felt well. About December 1st, while asleep, he had a rather severe left-sided convulsion, lasting about ten minutes. He came out of it somewhat dazed, but after a few minutes dressed and went to work. The next evening he had another convulsion, involving the entire left side, and after this he remained in a stupor about three hours. These convulsions, as well as all he has had, came without warning. He was still able to attend to his work, and about January 3d, while coming out of a saloon, he slipped and fell, cutting his head over the external angle of the left eye. He was unconscious about two hours, and he may have had a third convulsion, as the next morning he had partial loss of power in the left arm. The following week he had a very severe convulsion of a similar character, lasting about half an hour, and followed by still more loss of power in the left arm. On March 2d he had a peculiar staring look and rather slow, monotonous speech. His patellar reflexes were very much exaggerated and the tonicity of the muscles on the left side was increased. After walking a short distance he had a tendency to bend backward, and he would prop himself against a convenient pole or wall until he had rested. He had decided loss of motion in the arm, but he could use it better

than he had done a month previous. He showed no signs of syphilis.

On March 25th he had a fourth severe convulsion, limited to the left side, and followed by loss of power in the leg and left side of the face. Examination showed chronic inflammation of the optic nerves—more on the left side. He had some paralysis in the left side of the palate and throat muscles. He then was confined to bed. About April 10th he had another convulsion, which left him with the left side of his thorax absolutely paralyzed and an increased spasticity of arm and leg. His mental powers had steadily deteriorated, and occasionally he had visual hallucinations, and usually was like a child. His appetite was excessive. He had not had vomiting or fever. Occasionally he had involuntary evacuations of the bladder and he complained frequently of cramp-like pains in the spastic muscles of the leg and arm. The movement of the left thorax was very limited. Sensation for touch and pain was normal. The muscles of the left hand were slightly atrophied.

While under the charge of Dr. Appel he was treated with iodide and mercury until he developed coryza, sore throat, etc.

I first saw F. F. June 6, 1903. He had then just arrived from Lancaster. He had a staring expression, suggestive of brain tumor; his intellect was much clouded, but he understood simple questions, and replied to them correctly. $3+2$ he said $= 6$. $8-2=6$; $8-4=4$. His speech was thick and somewhat difficult to understand. His breath was offensive. He could move his head freely from side to side. The masseter muscle contracted firmly on each side. It was difficult to get him to draw up either corner of the mouth, and it was difficult to say whether or not the muscles about the corner of the mouth were weak, as he would not separate his lips. The tongue was protruded straight; it was not atrophied and showed no fibrillary tremor. The movements of the eyeballs were normal. Hearing was not determined, on account of the patient's stupor. He did not appear to be word-deaf.

The grasp of the left hand was fair, but not normal, and a little better than that of the right hand. Resistance to passive movement in both upper limbs was fair, but not normal. The muscles on the extensor surface of each forearm were somewhat atrophied. The biceps and triceps tendon reflexes and wrist reflexes were a little exaggerated on each side, but distinctly more so on the right side than on the left. His answers regarding sensation were not reliable, and yet when the upper limbs were stuck with a pin he made an effort to move them. The left upper limb was somewhat spastic; the right was not.

The left side of the thorax was flat and moved very little in respiration. Dulness on percussion was obtained over the upper part of the left thorax. A cardiac pulsation and thrill were felt in the left second intercostal space. A murmur also was heard at this

place, and was presystolic in time. Pulse was rapid, 112, and regular.

The movements of the lower limbs were very weak; those of the left lower limb more so than those of the right. The lower limbs appeared to be weaker than the upper. He could draw up the right lower limb with difficulty, but could not draw up the left at all, and merely raised this limb from the bed. He was able to put both upper limbs above his head. The lower limbs were emaciated, and the left was very spastic and distinctly more so than the left upper limb. The right lower limb was a little spastic, but not nearly so much so as the left. The patellar reflex was exaggerated on each side. The Achilles jerk was exaggerated on the left side. The Babinski reflex was not obtained on the left side; the big toe did not move at all, and the other toes were flexed. The Babinski reflex was obtained on the right side, and the big toe was moved slowly and distinctly upward. The man was unable to stand even with support, as his legs were flexed on the thighs and the thighs on the abdomen. A bedsore was present over the sacrum.

I was informed by Dr. Appel that the man had lost power first in his left upper limb. Each convulsion began in the left upper limb; the eyes were turned to the left, and the face was contracted on the left side. The left lower limb was never involved in the spasm until after the upper limb.

June 9th. Dr. Shumway reported as follows: Beginning optic neuritis; more decided in the left eye, in which the nerve shows some swelling. Nerve edges are obscured. Moderate tortuosity of veins.

Stereognostic perception is lost in the left hand and is normal in the right hand. He is unable to recognize a knife, pencil, or key with the left hand, but does so easily with the right hand. Sense of position is also lost in the left hand, and is normal in the right hand. He is unable to place the first finger of the right hand on the end of the first finger of the left hand if the eyes are closed. Pinprick is felt in both hands and forearms.

The left lower limb, except the toes, is almost entirely paralyzed. Any movement of this limb causes pain in the knee, and the knee is swollen; this possibly may explain why the weakness is greater than it was a few days ago. The patient is able to say correctly and without hesitation whether the big toe of either side is bent up or down; therefore, the sense of position in these toes is preserved.

11th. The mental condition is much better; he replies promptly to questions and understands better what is said to him. He does not draw up either corner of the mouth very far, but he seems to draw up the left corner a little farther than the right. When he closes his eyelids he has a peculiar fluttering of the upper lids, so that he is unable to keep the lids closed. He hears a low-ticking watch in each ear at the distance of about four inches. The grasp of each hand is feeble and about equal in the two hands. The interossei muscles in

each hand are somewhat atrophied and about equally so. The biceps and triceps tendon reflexes and wrist reflexes appear to be a little prompter in the right upper limb than in the left. Sensation for touch is much impaired, but not lost in the entire left upper limb, including a part of the left shoulder. Sensation for pain is almost normal in these parts, and both forms of sensation are normal in the right upper limb. The left upper limb is still somewhat spastic as compared with the right. He complains of tenderness on percussion in a spot about four inches directly above the external auditory meatus (probably the right side was meant). It is impossible to detect any change in the note in auscultation percussion of the head.

The left lower limb is very weak—much weaker than the left upper limb—and is very spastic. The right lower limb is apparently normal. The patellar reflex is much exaggerated on each side. The Achilles reflex is prompt on each side. The Babinski reflex is present on the right side, but feeble, and is not present on the left side. The lower limbs are emaciated and equally so. Stereognostic perception in the feet is uncertain. Sensation for touch and pain seems to be about normal in the lower limbs and feet. Ankle clonus is not obtained on either side. The patient is unable to stand even with assistance.

14*th*. Dr. de Schweinitz reported as follows: Double optic neuritis; 4 D.; right slight, and more extended in O. S. Paresis of right external rectus, with lateral diplopia in right field and nystagmic movement on right outer rotation. Visual fields normal with hand. Convergence near-point poor. O. D. diverges first.

15*th*. When he is told to place the first finger of the right hand upon the first finger of the left hand with eyes closed he seems to have no idea of the position of the left hand, and can touch his fingers only by feeling his way along the hand. If the hand of the examiner be placed near the patient's left hand he may touch the former and think it is his own hand. His mental condition has greatly improved. He has no hemianopsia. The left lower limb he can move with more power than he could a few days ago.

19*th*. The weakness of the left upper limb is greater to-day than it has been for several days, and the mental condition is not so good.

22*d*. The grasp of the left hand is more feeble than it has been since the first few days after he came to the hospital. The movements of the left fingers are awkward. The left lower and upper limbs are spastic. The right upper limb is a little spastic. The biceps and triceps tendon reflexes and wrist reflexes are exaggerated on both sides. Diarrhœa is severe to-day. Mercury and iodide are discontinued.

Because of the greater weakness in the left lower limb as compared with the left upper limb, the loss of stereognostic perception and of the sense of position in the left hand, the impairment of tactile sensation with preservation of pain sensation in the left upper

limb, the ataxia of the left hand, and the convulsive movements of the left side, a diagnosis of tumor of the right parietal lobe, encroaching especially upon the centre for the lower limb, was made. An operation was done by Dr. Frazier on July 23, 1903, and numerous small plaques were found in the right parietal region, extending into the area for the lower limb. They were too numerous to permit of removal.

An examination made July 25th, two days after the operation, showed that the man's mental condition was poor. He did not move his left upper limb when asked to do so. The left side of the face and the left upper and lower limbs were paralyzed, but he could move the left lower limb a little. He was said to move the right limbs freely. The right lower limb was rigid.

He died a few days after the operation, and the necropsy showed that these plaques were almost confined to the parietal lobe, but extended onto the median side of the lobe and the upper part of the postcentral and precentral convolutions. One or two small plaques were found elsewhere. None were found within the white matter of the brain, except where they had grown inward from the pia. They varied in size, but some were about a half-inch in one diameter and were flat against the brain. The microscope showed that they were tuberculous.

CASE V. *Tumor of the right cerebellar lobe at its union with the pons, correctly localized, and operation attempted but abandoned before the dura was opened, because of the patient's serious condition.*—W. C. B. was referred to me July 3, 1903, by Dr. W. F. Randall, of Dushore, Pa. The patient was a man past middle life. About Christmas, 1902, he began to complain of dull headache, not severe, and not occurring daily. During the past month or six weeks the headache had been severe. It had been frontal or occipital, and sometimes general; it came at any time, and usually lasted only a short time. The patient began to vomit about April, 1903; at first he vomited only in the morning, but now vomits at any time. Dizziness does not appear to have been present. He has not had convulsions. His sight has been poor for two months; his intelligence is good. He has been growing weak during the past three weeks, and the weakness is general—not greater on one side than on the other. The grasp of the hand is good on each side. The movement of the lower part of the right side of the face is not so good as that of the left side. The forehead is moved voluntarily and equally well on each side. He closes the eyes firmly on each side. The tongue is protruded straight, and not atrophied. Voluntary movements of the upper limbs are free, and the grasp of each hand is good. The biceps tendon and triceps tendon jerks and wrist reflexes are about normal on each side. Touch and pain sensations are normal in the face and upper and lower limbs. The patellar reflex is prompt on the right side but diminished on the left side. Ankle clonus and

Babinski's reflex are not present on either side. He has dizziness when he sits up, and in walking staggers and always toward the right. He is unable to stand erect with feet together, and his wife says that his tendency to fall is always toward the right. His memory has been failing during the past month.

July 16th. The patellar reflex is diminished on each side—a little more so on the left. Ankle clonus and Babinski's reflex are not present on either side. Achilles jerk is present but diminished, and more so on the left side. Hemiasynergy is very pronounced in the right lower limb, and is not present in the left. When the right leg is flexed on the thigh and the thigh on the abdomen as far as possible, and then an attempt is made to extend the right lower limb, he extends first the right thigh, and later, when the limb is almost ready to be placed upon the bed, he extends the leg on the thigh.

The patient's wife said that before he came to the hospital he yawned much in the daytime.

He has no tremor in movement of the upper limbs. He places the first finger of either hand on the end of the nose well.

The report of the ophthalmic examination by Dr. de Schweinitz is as follows: Double optic neuritis (choked disks); swelling about 5 D.; many hemorrhages; paresis apparently of right external rectus; pupils prompt; right halves of visual fields contracted, but line does not run quite to fixation point left and only half-way right. They seem somewhat uncertain.

The report from Dr. B. A. Randall is as follows: The right ear hears all tones less distinctly than the left, but distinguishes from 200–20,000 d. v. s. Bone-conduction preponderates over air, but is slightly subnormal where it should be exaggerated if trouble were tympanic only. Drumheads fair in appearance. No acoustic defect of left noted. There seems to be nerve lesion combined with tympanic on the right.

Examination of the blood showed: hæmoglobin, 75 per cent.; red blood cells, 5,312,000; white blood cells, 9840.

23d. During the past three days the patient has had very severe attacks of headache, usually frontal, but occasionally occipital, and during these attacks he has been very restless. He has had some morning vomiting. His wife says that his mental condition is worse, and he does not understand what is said to him. Stereognostic perception is normal in each hand. Right hemiasynergy is distinct. Resistance to passive movements is normal in the upper and lower limbs. Some nystagmoid movement is present on looking to the right or left. Sense of position is normal in the hands, but the tests for the toes give uncertain results.

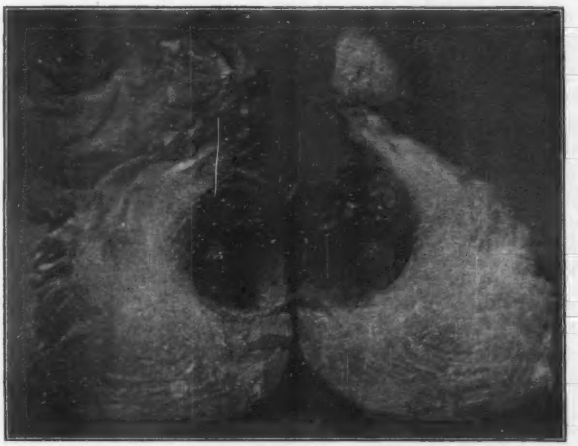
25th. The right side of the forehead is not wrinkled as well as the left, nor does he draw up the right corner of the mouth as well as the left. He yawns frequently. No tenderness of scalp is found on percussion. The patellar reflex is much diminished on the right side,

and not obtained on the left side. The patient has had fine twitching movements of the right extremities, although at times the movements have been on both sides of the body.

This case was seen by Dr. C. K. Mills in consultation.

An operation for the removal of a tumor believed to be in the right cerebello-pontile angle was done by Dr. Frazier July 23, 1903. The patient's condition was so serious that further operation had to be postponed after the bone was cut through. He died July 24th.

At necropsy a cyst was found in the right cerebellar lobe. Its inner wall extended to the union of the right cerebellar lobe with the pons. Its outer wall extended to the surface of the cerebellar lobe,



Photograph of the right lobe of the cerebellum from Case V. The lobe has been cut in half. The cyst, with a small tumor in its wall, is shown at the lower part of the cerebellar lobe. The upper part of the photograph represents the medulla oblongata.

but not beyond. Small tumor masses were found in the upper and inner wall of the cyst, and these, under the microscope, had the structure of a spindle-cell sarcoma. The cyst, with the tumor masses in its walls, could be easily enucleated. It measured 3.3 cm. from without inward and 2.4 cm. from above downward.

The vessels of the brain had been torn away, and it was impossible to say whether thrombosis had occurred or not.

A brief summary of the last four cases is as follows:

Case II. The symptoms were paresis of the right side of the face and of the right upper and lower limbs, some motor aphasia, diminution of each patellar reflex, frontal and occipital headache, and convulsive movements of the right upper limb, but not of the lower. The patient did not have nausea, vomiting, vertigo, Babinski's sign, disturbance of sensation, loss of stereognostic perception, nor optic neuritis.

An infiltrating spindle-cell sarcoma was found in the second left frontal convolution, extending into the middle of the precentral and postcentral convolutions and the upper part of Broca's area.

Case III. Syphilitic infection was acknowledged. The symptoms were severe headache on the right side during five years, convulsive movements of the left side of the face and of the left upper limb, but not of the left lower limb, a little weakness of the left side of the face, and nowhere else, gray degeneration of the optic nerves, paralysis of one third nerve and paresis of one fourth nerve, and loss of the iritic response to light and in accommodation. The patient did not have nausea, vomiting, dizziness, optic neuritis, alteration of tendon reflexes, Babinski's sign, nor loss of stereognostic perception. Later, some weakness of the left upper limb was noticed, and sensation became impaired in the left upper limb and in the left side of the face, and stereognostic perception and sense of position became impaired in the left hand. Still later, the left upper and lower limbs became completely paralyzed, and motion in the left side of the face became imperfect. A subcortical mixed sarcoma (round and small spindle cells) was found in the right cerebral hemisphere. Its central portion was beneath the middle part of the motor area. Its outer border was 1.5 cm. below the surface of the brain.

Case IV. The symptoms were frontal and occipital headache, convulsive movements of the left side of the body, impaired mentality, some weakness of upper and lower limbs, greater on the left side than on the right, spasticity of the lower limbs, exaggeration of tendon reflexes, Babinski's sign on the right side, but not on the left; optic neuritis greater in the left eye, loss of stereognosis and of the sense of position in the left hand, impairment of tactile sensation, but not of pain sensation, in the left upper limb, and awkwardness of the movements of the left fingers. Numerous tuberculous plaques were found, almost confined to the right parietal lobe, except where they extended into the upper part of the postcentral and precentral convolutions.

Case V. The symptoms were occipital, frontal, or general headache, vomiting, general weakness, paresis of the lower part of the right side of the face, dizziness, staggering toward the right, diminished patellar reflexes, right hemiasynergy, frequent yawning, double optic neuritis, paresis of right external rectus, central deafness on the right side, some nystagmus on lateral movement, and impaired mentality. A cyst with small sarcomatous masses in its walls was found in the right cerebellar lobe at its union with the pons.

In Case II. the convulsions in the right side of the face and in the right upper limb, the weakness of the right side of the face and of the right upper and lower limbs, the partial motor aphasia, were indicative of a focal lesion, probably a tumor, in the left side of the brain, and chiefly in or near the centre for the upper limb. As the convulsions probably had not implicated the right lower limb, it

seemed more likely that the tumor had grown inward and involved the fibres coming from the centre for the lower limb in their course from this centre to the internal capsule. The absence of convulsions in the right lower limb seemed to indicate that the cortical centre for this limb was not irritated or else irritated after the fibres from this area had been cut. It was not surprising, therefore, to find a tumor within the brain in the area indicated. Especially noteworthy in this case was the absence of optic neuritis, nausea, vomiting, and dizziness.

The tumor was entirely removed, so far as we could determine, and was one of the smallest I have ever seen taken out at an operation. It was not very much larger than an English walnut. Our desire should always be to remove a tumor while it is still very small, but we are usually unable to accomplish this, as the symptoms are not sufficiently indicative of the position of the new-growth in its early development.

We felt very much pleased on account of the great improvement and, indeed, almost complete recovery following the operation for a period of about seven weeks. If the tumor had been well defined from the surrounding tissue a return might not have occurred. The necropsy showed a tumor that could at no point be outlined from the surrounding brain tissue.

We were very desirous of making another attempt to remove the growth, but the man's general condition was not such as to warrant this on account of signs of pneumonia.

Restoration to health for a period of seven weeks is by no means to be despised, and if, at the operation, we had removed more of what seemed to be healthy cerebral tissue surrounding the tumor the recurrence might have been prevented or delayed much longer. In every case in which a tumor is infiltrating and has the appearance of a sarcoma I would recommend that surrounding brain tissue should be removed, even though it appears to the naked eye to be healthy, and even though paralysis is likely to be increased by this removal.

In Case III. syphilis was acknowledged, and the headache existing many years, the paralysis of the right internal rectus extending over a period of eight years, and the loss of the iritic response to light and in accommodation made the case appear as one of syphilitic meningitis. Antisyphilitic treatment was thoroughly employed, without distinct benefit, but this did not prove that the case was not one of syphilitic meningitis. I have seen vigorous administration of mercury and iodides have little effect on advanced cerebral syphilis where many symptoms suggested the existence of brain tumor. These cases should be regarded, at least clinically, as cases of brain tumor, and so treated—*i. e.*, by operation, where operation is permissible.

The convulsions involving the left side of the face and the left

upper limb were indicative of a lesion in the corresponding cortical centres for these parts. At first there was weakness only in the lower part of the left side of the face, but later the left hand-grasp became weak. The stereognostic perception became impaired in the left hand, the sense of position became impaired in the left thumb, and tactile and pain sensations became impaired in the left upper limb. Sensations of touch, pain, and temperature also became a little impaired in the left side of the face. The lesion seemed to be in the face and upper limb centres and the adjoining part of the parietal lobe, and it was believed to be cortical or very near the cortex, because of the typical Jacksonian epilepsy.

The area mentioned was exposed, but a distinct tumor could not be found. I regret that the brain was not punctured more freely in the exposed area. I have seen punctures made so often at operations for brain tumors without any effect, except possibly some increase in the paralysis after the operation, that I had grown a little lukewarm toward this procedure. In Case III. the tumor was softened and partly fluid in its lower portion, and repeated punctures might have caused the escape of some of the fluid and the detection of the tumor. It was so far below the cortex that its complete removal might have been uncertain, and, probably, would have been impossible.

In this case, as well as in Case II., optic neuritis did not exist, and this sign was, therefore, absent in two of the five cases, and yet in each of the two cases the diagnosis of tumor of the brain was made. One was a tumor of the middle motor area, and the other a subcortical tumor of the lower parietal and lower motor area. Choked disk is one of the most common signs of brain tumor, but is not always present. Oppenheim,[1] in his monograph on brain tumors, in regard to this subject says that he has found typical choked disk in fourteen and optic neuritis in five of twenty-three cases—*i. e.*, in 82 per cent.; that Gowers found it in four-fifths of his cases, and Knapp in two-thirds of his cases. Oppenheim expresses the opinion that, as in recent years the diagnosis of brain tumor has been made earlier and confirmed by operation, choked disk is not so frequently seen. Although papillitis does not depend entirely on the location of the tumor, he thinks it is almost a constant and early sign of tumor of the cerebellum. It is relatively often absent when the tumor grows from the meninges and presses against the brain, also in cases of cortical tumors that do not penetrate far into the white matter, and of tumors of the pons, medulla oblongata, and corpus callosum. Tumors of the occipital lobe, he thinks, cause optic neuritis late.

Mills,[2] in his text-book, remarks that optic neuritis is probably present on both sides in from 60 to 80 per cent. of all the cases of

[1] Die Geschwülste des Gehirns, second edition, p. 63.
[2] The Nervous System and Its Diseases, p. 510.

brain tumor, but that statistics on the subject are somewhat conflicting. It has been noted, he says, in only about 50 per cent. in tumors of the motor cortex.

Starr[1] says unhesitatingly that optic neuritis is present in 80 per cent. of the cases of brain tumor.

The occurrence of Jacksonian epilepsy in Case III., in which a tumor existed 1.5 cm. below the cortex, was somewhat misleading in making a diagnosis.

In the third edition of his text-book Oppenheim[2] says that unilateral convulsions may occur from lesions of the subcortical substance, especially when they implicate the fibres from the motor zone. The convulsions are not exactly like those of Jacksonian epilepsy, and when they resemble them more closely they are caused by lesions that affect the cortex by pressure, etc.

Dejerine,[3] in speaking on the same subject, remarks that typical attacks of Jacksonian epilepsy rarely may occur from limited subcortical lesions. He observed a case in which the convulsive movements began in the hand, and a tubercle was found in the white matter of the brain 1 cm. beneath the cortex.

In Case III. typical Jacksonian epilepsy was observed when the tumor was so far as 1.5 cm. below the cerebral cortex, and as the growth was 4 cm. in transverse diameter it must have been still further below the cortex when it first developed. This is possibly the first case in which a subcortical tumor so deeply situated caused typical Jacksonian epilepsy.

In Case IV. paralysis of the left side of the thorax was said to have occurred during a convulsion. The necropsy showed that the left lung was entirely atelectatic. It seemed to me impossible that the left side of the thorax could be completely paralyzed as a result of a unilateral cerebral lesion. I have never observed such a condition, and I am not aware that others have. Muscles on the two sides of the body that contract synchronously are not paralyzed by a unilateral cerebral lesion.

Especially interesting in this case, and of great diagnostic value, were the loss of stereognostic perception and of the sense of position in the left hand, the awkward movement of the left fingers, and the impairment of sensation for touch, but not for pain, in the left upper limb. These signs were indicative of a lesion of the parietal lobe. Absence of hemianopsia made an implication of the sensory fibres in the internal capsule and, therefore, a lesion near the visual fibres, improbable, and the typical Jacksonian epilepsy pointed to a cortical lesion.

The loss of the sense of position was so marked in this case that the patient was unable to find his left hand with his right hand when

[1] Organic Nervous Diseases, p. 600.
[2] Lehrbuch der Nervenkrankheiten, third edition, p. 605.
[3] Sémeiologie du Système Nerveux, p. 523.

his eyes were closed, and he frequently took hold of my hand believing it was his own.

Although I fully believe that a lesion of the parietal lobe may cause ataxia, loss of stereognostic perception, and loss of the sense of position and some disturbance of tactile and possibly of pain sensation in the limbs of the opposite side, I have not been convinced that a lesion of the motor area will give none of these symptoms.

In a recent paper Marinesco[1] remarks that Jonesco removed a part of the cortical centre for the left upper limb in a man. After the operation the patient could move his shoulder and elbow very well, but not his hand. Nine months later the movements of the left hand were very imperfect, and tactile sensation, the sense of position, and stereognostic perception were diminished in the left hand. In another case Jonesco removed the centres of the face and upper and lower limbs of the right cerebral cortex. A year after the operation there was much weakness of the left side of the body, and the sense of position, stereognostic perception, and tactile sensation were affected in the left upper limb. Thermal and painful sensations were preserved. These operations were done for epilepsy, and in one case, at least, and probably in both, the cortical motor areas were determined by the electric current.

I have observed loss of stereognostic perception caused by lesions much below the cortex of the brain, viz., in a case of tumor of the pons (Potts and Spiller) and in a case of tumor compressing the medulla oblongata (case of Dercum); but where the symptoms indicate a tumor of the cerebrum that probably is cortical, I believe the loss of stereognostic perception and of the sense of position and ataxia of the upper limb of the side opposite to that in which is the lesion indicate much implication of the parietal lobe.

In 1898, at a meeting of the Philadelphia Neurological Society, I[2] referred to a case that I had seen in the service of Dr. Lloyd, at the Philadelphia Hospital, which seemed to show that the cortical representation of the sense of position is in the parietal lobe. A man complained, during the night preceding his attack, of fatigue, headache, and inability to sleep. The following morning he fell on the floor on attempting to rise from his bed, but was not unconscious. When he was found he had paresis of the left limbs and of the left side of the face and tongue. Later the patient could raise his left upper limb above his head, but every movement of this limb was ataxic in an extreme degree, though the limb was not paralyzed. The mental condition of the patient prevented an examination of the condition of sensation. At the necropsy a hemorrhage was found in the right parietal lobe. The hemorrhagic area was about 2 cm. in diameter, and extended inward in the form of a cone to the lateral ventricle, having its base in the cortex. It

[1] Semaine médicale, October 7, 1903, p. 325.

[2] Journal of Nervous and Mental Disease, January, 1899, p. 43.

was situated about 4 cm. from the longitudinal fissure and about 2 cm. or 3 cm. behind the Rolandic fissure. The brain had been cut into frontal sections about 1 cm. apart, when we had an opportunity to examine it, and, although the injury to the cerebral tissue prevented an exact determination of the location of the hemorrhage, it was evidently in or very close to the supramarginal gyrus. The ataxia was probably caused by a loss of the sense of position.

This was probably one of the first cases reported in this country, showing that ataxia from a loss of the sense of position may be caused by a lesion of the parietal lobe. The case of Starr and McCosh preceded it.

A case that Dr. C. K. Mills and I saw together, June 3, 1901, in consultation, the case being under the charge of Dr. Ida Richardson, affords evidence also of the localization of the stereognostic perception and of the sense of position in the parietal lobe. The patient's left upper limb was decidedly ataxic, paretic, and astereognostic, and the head was retracted and rigid. The necropsy was made by Dr. W. F. Hendrickson. An area of depression, indefinite in outline, but about 6 cm. in diameter, was found in the parietal lobe of the right cerebral hemisphere just posterior to the fissure of Rolando. Palpation revealed less resistance at this point than over the surrounding tissue. On section this area was found to be the seat of extensive softening. The process implicated practically the entire right parietal lobe.

The case reported by C. K. Mills,[1] which was seen by me and others in consultation, was one of the first to establish the localization of the stereognostic perception in the parietal lobe. A diagnosis of tumor of this lobe was made because of the loss of the sense of position, the impaired cutaneous sensibility, astereognosis, and ataxia. The case has been so fully reported by Dr. Mills and is so well known that I need not refer to it further.

Oppenheim,[2] after giving a description of his case of parietal tumor with operation, remarks that lesions of the parietal lobe cause ataxia of one or both limbs of one side. Irritative or paralytic motor symptoms are absent, or when they occur they are the result of pressure. The sensory disturbance is always a partial hemianæsthesia, in that pain and temperature sensations are preserved, while tactile sensation and especially the sense of position and the stereognostic perception are impaired or lost. Such a symptom-complex occurs when the lesion does not extend far into the white matter of the parietal lobe. He says, also, that the cases in which tumor of the parietal lobe has been so accurately diagnosed that a radical operation was possible are very few.

This case of Oppenheim was reported by him February 12, 1900,

[1] Mills, Keen, and Spiller. Journal of Nervous and Mental Disease, May, 1900, p. 244.
[2] Mitteilungen aus den Granzgebieten der Medizin und Chirurgie, 1900, vol. vi. pp. 382, 383.

and published in the third number of the sixth volume (1900) of the *Mitteilungen*.

In his monograph[1] on tumors of the brain he says that in the majority of cases of tumor of the parietal lobe sensory irritative and paralytic phenomena were observed. He refers to Mills' case, but adds that the cases are not sufficient to permit us to regard the above-mentioned phenomena as positive evidence of lesions of the parietal lobe. The evidences of the localization value of these symptoms are, however, rapidly accumulating.

In March, 1901, C. W. Burr[2] reported a case in which there were slight hemiplegia, slight tactile anæsthesia, astereognosis, mind blindness, loss of the temperature sense on one side, sensory aphasia varying in intensity, and mental dulness. In this case a tumor was found in the parietal lobe, pressing against but not invading the ascending parietal convolution, partially destroying the angular gyrus, and involving almost the entire posterior parietal lobule.

The meningitis in plaques that occurred in Case IV. is of a very unusual character. The best paper on the subject that I know of is by Combe. He says that the meningitis in plaques (méningite en plaque of the French writers) is an unusual form of tuberculosis, and yet one that should be recognized. Tuberculosis of the central nervous system may appear as one or more tumors of different size, some small and some large; or it may appear as numerous minute tubercles scattered along the bloodvessels; or it may appear in plaques. Combe described the last form in 1898, although it was known to Landouzy, Dupré, and Chantemesse. The meningitis in plaques, as described by Combe, predominates on the convexity of the brain, and scarcely implicates the base at all. The inflammation is circumscribed and causes little exudation; it is almost always situated about and in front of the fissure of Rolando—*i. e.*, in the motor zone. It occurs as one or several plaques of different size and thickness, and consisting of agglomerated granulations and fibrinous deposits. The pia is thickened about the plaques and contains miliary tubercles. The pia is normal over the rest of the brain, or else hyperæmic and thickened. The base of the brain, the interpeduncular space, the bulb, and the cranial nerves are not affected.

This form of meningitis does not cause basal symptoms; usually there is no vomiting, no constipation, no slowness and no irregularity of the pulse, no strabismus, no intense headache, no choked disk. The localization in the motor area explains the Jacksonian epilepsy and paralysis of the opposite side of the body. It is not surprising, therefore, that most of the cases mentioned by Chantemesse had not been correctly diagnosed from the clinical symptoms.

The common form of tuberculous meningitis occurs more fre-

[1] Oppenheim, Die Geschwülste des Gehirns, second edition, p. 116.

[2] THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, March, 1901, p. 306.

quently in children, while the meningitis in plaques is found more frequently in adults.

Combe[1] says that in every case in which the meningitis in plaques appeared to be primary, miliary tuberculosis or local tuberculosis not causing any symptoms has been found.

The dura is usually normal, but sometimes adherences with the plaques are found. The paracentral lobule is the part usually affected.

According to F. Raymond[2] these plaques are really tubercles, and are caused by an infection conveyed by means of the cerebrospinal fluid.

E. F. Trevelyan[3] says that he has seen nine cases of the meningitis in plaques.

In my Case IV. the plaques were situated behind the fissure of Rolando in the parietal lobe, and not in front of the fissure, where Combe says they are more commonly found. The dura was adherent to a few of these plaques. The optic chiasm examined by microscopic sections showed no evidence of meningitis, and yet this part is usually a favorite location for meningitis.

In Case V. the movement of the lower part of the right side of the face was not so good as that of the left side. The patient always staggered toward the right in walking, and hemiasynergy of the right lower limb as described by Babinski was found on two or three occasions—*i. e.*, when the right leg was fully flexed on the thigh, and the thigh fully flexed on the abdomen, and the patient then attempted to extend the limb and place it on the bed, the movements of the lower limb were not synergic; the leg was not extended simultaneously with the thigh. Babinski thinks that this hemiasynergy is present on the side on which the cerebellar tumor exists. I have observed the sign in four cases of supposed cerebellar tumor, but only in this, Case V., have I been able to establish its reliability by necropsy. In Case V. the patellar reflexes were diminished on each side. Deafness of central origin in the right ear was reported by Dr. B. A. Randall. Nystagmoid movements were present when the patient looked to either side. These were the chief signs that led me to diagnose a tumor of the right cerebellopontile angle, and the diagnosis was correct.

Repeated yawning was observed in Case V. I have seen this when the symptoms indicated a lesion somewhere at the base of the brain, and I look upon it as a sign of a lesion at this part and not in the cerebral cortex. Oppenheim thinks it is not a rare sign of cerebellar tumor, but I believe it may be seen in cases of tumor elsewhere at the base.

I was unable to observe that the nystagmus was greater in devia-

[1] Revue médicale de la suisse romande, 1898.

[2] Leçons sur les maladies du système nerveux, 1900, fourth series, p. 24.

[3] Lancet, November 7, 1903, p. 1276.

tion of the eyes to the right, the side of the lesion, than in deviation toward the left. In a case of cerebellar abscess that I saw in consultation with Dr. B. A. Randall the nystagmus was much greater when the eyes were turned toward the side of the lesion than when they were turned away from it. I have not been able to make this observation in any other case, but I speak of it in the hope that it may prove to be of clinical value.

Oppenheim describes involuntary movements, tremor, occurring in cases of cerebellar tumor, and such movements were present in Case V.

A DISCUSSION OF THE SURGERY OF TUMORS OF THE BRAIN, WITH A RESUME OF THE OPERATIVE RECORDS OF FOUR CRANIOTOMIES.

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The statistics of the last five years give us every reason to take a more hopeful view of the surgery of cerebral tumors. It will be admitted without question that the greater attainments of more recent years are to be attributed to an earlier recognition of the tumor, to a correspondingly earlier resort to operation, to more accurate localization, and, finally, to certain distinct improvements in the technique. The latter may be said to include a speedier method of opening the skull, the exposure of a much larger area of the brain than was possible before the introduction of the osteoplastic flap, the adoption of the two-stage operation in those cases in which the blood pressure is materially depressed by the preliminary procedures. Many of the improvements or modifications of the technique in operations upon the brain have in view a common object, the prevention of shock. Operating as we are upon such a highly sensitive organ as the brain, and upon the organ which presides over functions so essential to the maintenance of life, additional precautions must be taken. The precautions which one ordinarily takes to prevent shock in operations upon other organs must be observed in brain operations the more stringently; the avoidance of unnecessary exposure, the avoidance of unnecessarily prolonged operation, the prevention of excessive hemorrhage, the avoidance of unnecessarily rough manipulations of the tissue, the administration of the anæsthetic by an experienced man; careful observation of the patient's condition, more particularly of the circulatory function, throughout the operation at frequent intervals; these are all points to which the greatest importance should be attached.

METHOD OF MAKING THE OSTEOPLASTIC OR WAGNER FLAP. The instrument which in our experience at the University Hospital seems to meet every indication is the so-called dental engine armed with a trephine and drill. Given an area of brain to expose, an osteoplastic flap of corresponding size can be made with much less traumatism and in a much shorter time with this instrument than with any other. Objections to other instruments may readily be found. In fashioning the flap with chisel and mallet a degree of traumatism must be inflicted upon the nervous structures within the skull, which is, to say the least, undesirable, and in the opinion of some surgeons the hammering increases the shock, and thereby adds to the risk of the operation. As compared with any of the other methods this is by all odds the crudest. The Gigli saw may be used, but a good deal of time is consumed in making the necessary number of trephine openings, and passage of the saw from one opening to another is neither an easy nor, in all cases, a safe procedure. The Stellwagen trephine, which was placed on the market a little over a year ago, is an ingenious instrument, but, from the mechanical point of view, is not to be compared with the dental engine. The efficacy of the Stellwagen trephine depends upon the ability to fix the central plate —this can only be accomplished by screwing the plate to the skull; but even after the central plate has been secured in place it requires a good deal of practice and force to be able to saw through the entire thickness of the skull in a reasonably short time. But there is still another and what I consider a very serious objection to this instrument, namely, the loss of a considerable amount of blood before the flap is reflected and the hemorrhage controllable. The greatest amount of bleeding comes from the venous channels in the diploë; with the Stellwagen trephine one begins to saw through the skull layer by layer from without inward until one reaches the diploë; upon reaching the inner table of the skull, one must proceed more slowly and with greater caution, because of the danger of penetrating the dura and injuring the brain. Meanwhile, hemorrhage from the diploic vessels is very free, and, of course, uncontrollable until the bone is entirely divided and the flap reflected. The drill of the dental engine divides the entire thickness of bone as it proceeds; furthermore, it seems to crush and occlude the openings of the diploic sinuses, and in that way spontaneously controls hemorrhage. Including the series of cases recorded in this paper, I have performed in the last six months some ten craniotomies with the dental engine, and I believe that with this instrument a given area of the brain can be exposed with the minimum degree of traumatism and in the minimum amount of time. The element of time plays a most important part in the outcome of operations for brain tumor. Mills,[1] in a paper presented to the College of Physicians in 1902, said: "I

[1] Philadelphia Medical Journal, September 27, 1902.

am satisfied that the present dangers to life in operations for brain tumor are from hemorrhage and prolonged operation." Therefore, the addition to our armamentarium of an instrument which economizes time will tend toward lowering the mortality. In the absence of complications it is quite possible without undue haste to completely divide and reflect the bony flap in eight minutes. It requires but very little practice to become proficient in the use of this instrument. After the incision has been made in the scalp, corresponding to the size and shape of the flap, an opening in the skull at one extremity of the incision is made with a small trephine operated by the engine. This will consume but a fraction of a minute. A small dural separator is inserted in the opening in order to make sure that the dura is free from the bone before the bone-drill is introduced. This can be attached to the engine without any risk of the operator's hand coming in contact with any portion of the engine that may not be sterile. The drill is now introduced and the bone divided from one extremity of the incision to the other. To guard against the possibility of the wound becoming infected from particles of dust that may be cast off from the arm or pulleys of the electric motor, an assistant plays a stream of sterile water or normal salt solution over the field of operation while the machine is in motion. But two objections to this method of performing craniotomies suggest themselves: one, the possibility of infection; the other, the possibility of dividing the dura and lacerating the brain substance should the dura be adherent.

I have already referred to the manner in which infection may be guarded against. The danger of dividing the dura and lacerating the brain substance in those cases in which the dura is adherent is not incurred by this method more than by any other. No matter what the instrument selected for dividing the bone, if the dura be firmly adherent to the skull it will be exposed to the possibility of laceration. One of the advantages of making the flap of liberal dimensions is that there will be a margin of normal tissue between the lesion and the edges of the osseous opening. The possibility of the line of the bone-flap traversing the affected area is more remote.

McCosh, of New York, makes use of the electric engine in his craniotomies. A small bulb of the shape of a pear, about one-quarter of an inch in diameter, is attached to the engine, and with this bulb four or five holes are bored through the skull; the cone shape of the bulb allows the point to penetrate through the skull as it is revolved, and yet prevents the shaft from entering the skull or penetrating the dura. When the holes have been made the bulb is removed, and there is substituted a small circular saw, and the bone between the holes made by the burr sawed through. A small projecting and protecting flange is screwed to the side of the circular saw, so that the blade of the saw is exposed only for the depth of the skull as measured through the holes, and in this way the danger of sawing

through the dura is wholly obviated.[1] This instrument would, it seems to me, require much more practice in order to enable one to operate it with safety. If one depends, in the adjustment of the flange, upon the depth of the skull measured at any one of the holes the danger of sawing through the dura cannot, as it is claimed, be wholly obviated. The depth or thickness of the skull varies, so that there would always be the possibility of the saw penetrating the dura if the skull were thicker at one of the holes than elsewhere, or what is also an objection, though not such a serious one, the saw would not penetrate the entire thickness of the skull if the skull were thinner at the point measured than it was at some other point along the projected incision.

Control of Hemorrhage. Exceptional precautions should be adopted to control hemorrhage from the very outstart. The amount of blood which will be lost from an extensive incision of the scalp might be considerable. The loss of blood will be reduced to a minimum by the application of a tourniquet around the head. I have been in the habit of using for this purpose rubber tubing. Dr. Cushing showed me recently an appliance for this purpose which seemed to me very superior. It consists of an inflatable tube, which fits snugly the head of the patient, and with a small bicycle pump can be distended sufficiently to exert the necessary degree of pressure. If no tourniquet is used, it is a good plan to make the incision section by section, stopping to control the hemorrhage from one section before proceeding to the next. Hemorrhage from the diploic sinuses is satisfactorily controlled by Horsley's wax. When we come to the question of the control of hemorrhage from the brain and tumor itself, we are confronted with a more difficult problem. But two courses are open: one to pack gauze firmly into the wound, the other to close one or both carotids temporarily. The latter course would seem to be the ideal course were the practice of it unattended with risk. Crile, to whom we are indebted for this suggestion, performed this preliminary operation in a series of cases without any serious after-effects. It seemed to me that, if as in Crile's hands this operation were free from danger, a very important contribution had been made to the technique of brain surgery. My personal experience, however, has not confirmed these views. In the first place, temporary closure of the carotids does not altogether control hemorrhage; it controls arterial hemorrhage, but upon the venous hemorrhage, which is the much more troublesome, it has little effect. But in addition to the control being ineffectual, it is not unattended by risk, at least it has not been in my hands. I have practised temporary closure of the carotid but five times in all, including two of the cases in this report, and from this limited experience I am firmly of the opinion that Crile's method should be reserved for the extreme cases, and in these should be confined to one side.

The posture of the patient during the operation should, of course,

[1] Starr. Journal of Nervous and Mental Disease, July, 1900.

not be overlooked. Hemorrhage will be less free if the patient's head and body are well elevated. Unless the patient is in a state of shock I am in the habit of continuing elevation of the head and shoulders after the patient is transferred from the operating-table to his bed.

Observations upon the Blood Pressure. One of the signs of increased intracranial tension of whatever origin is elevation of the blood pressure. It is present in depressed fractures of the skull, in intracranial hemorrhage, in cerebral contusion and concussion, as well as in brain tumor. In a very exhaustive work on concussion and cerebral compression by Kocher and his students, the effects of intracranial tension upon the circulation of the brain were studied. It was observed that when the compression was of a very moderate degree there developed primarily a venous stasis or disdiamyrrhosis. This was due to the obstruction of the venous circulation by the increased intracranial pressure. If this pressure continues or increases the circulation of the brain becomes re-established; this phenomenon is attributed to a stimulation of the vasomotor centre, which, acting through the peripheral vessels, causes such an increase in the arterial pressure as will compensate for the increased cranial tension. And so it is that in the presence of a brain tumor we often find the blood pressure elevated above normal. In all operations for the removal of brain tumors I have made it a practice to make an observation of the blood pressure before the operation and to have the observations upon the blood pressure continued throughout the operation. These observations are recorded on a chart designed for this especial purpose; on it are recorded by an assistant a tracing of the pulse and blood pressure in such a way that the operator can see at a glance what the pulse rate and degree of blood pressure may be. The sphygmograph,[1] which is used in my clinic, is very simple in its construction, and can be operated without any difficulty by an untrained assistant.

The object in having this record made throughout the operation is twofold. In the first place, generally speaking, the condition of the blood pressure is the most reliable index of the patient's condition; when the normal blood pressure is sustained throughout the operation we are assured that the operative procedures have not been of sufficient gravity to induce shock. This applies, of course, to operative procedures generally, and is not confined to those upon the brain; but in operations for the removal of tumors of the brain the blood pressure index is of much greater significance, in that it assists us in determining whether the operation should be performed in one or two stages.

Indications for Two-stage Operation. It has been said that 25 per cent. would be considered a conservative estimate of patients who died immediately from the effects of operation. In some cases death is attributed to shock, in some to concussion, and in some to

[1] It is a modification of the Riva-Rocci instrument that was worked out by Dr. Stanton, Instructor in Medicine at the University of Pennsylvania.

"unknown causes." In a discussion on the subject of brain tumors at the October meeting of the College of Physicians I said that I was inclined to believe that in the latter class of cases death was due to the sudden withdrawal of intracranial pressure. In the investigations of Kocher, that have already been referred to, it was demonstrated that the sudden withdrawal of intracranial pressure, after the blood pressure had been forced to a considerable height, may be followed by paralysis or break down of the vasomotor mechanism. If we are correct in assuming that this theory will explain many of the fatal terminations in a given number of cases, we should give more serious consideration to the advisability of dividing the operation into two stages. Horsley recommends the adoption of this procedure in every case without exception, and v. Bergmann, though not going so far as Horsley, recommended the two-stage operation in cases in which the patient's general condition was below par, or in which the tumor was a particularly large one. Horsley's recommendation seems to me unnecessarily radical, and that of v. Bergmann too indefinite. It seems to me a rule may be formulated which is based upon a much more scientific basis, namely, that when after the relief of pressure, such as would follow the removal of the osteoplastic flap and the reflection of the dura, there is a very decided fall in the blood pressure, an attempt should not be made at that sitting to remove the tumor. The completion of the operation should be postponed until the circulatory equilibrium has been restored, that is, until the circulation of the brain has become adjusted to the newly instituted physical conditions. This may mean the delay of a week or a delay of but forty-eight hours. [In order to determine in more exact terms the effect of the sudden removal from the brain of such pressure as would be exerted by a tumor, I am conducting a series of experiments upon dogs, in which an inflated rubber bag is introduced beneath the dura and distended so gradually as to simulate the growth of a tumor; when the bag is distended to a considerable size the fluid will be withdrawn suddenly, and the effect of the collapse of the bag upon the blood pressure will be recorded.]

In Case III. of this series such a course was adopted. The patient had a large subcortical tumor. Soon after the dural flap was reflected there was such a fall of blood pressure that I decided to postpone for the time being further operative intervention. The patient soon recovered from the effects of the preliminary step, but I feel quite sure that if I had continued with the operation and attempted to remove the tumor the circulatory disturbance would have been aggravated, and the patient would have died. In Case II. it will be noted in the chart that after the completion of the first stage of the operation the patient was not suffering from depression of the circulation. Accordingly, I proceeded and removed the tumor. The tumor proved to be a small one, so small that its presence had not caused enough increased tension to disturb the circulation, and the removal was effected, therefore, without affecting the blood pressure.

Sommer[1] reports his experience in an operation for sarcoma of the brain. Death ensued a few hours afterward for no demonstrable reason. The author says that in this as in many other cases death is due to sudden change in the circulation. His views coincide with mine. As a means of relieving pressure he recommends lumbar puncture in addition to the reflection of the osteoplastic flap as a preliminary measure, postponing for a few days any attempt to remove the growth. Lumbar puncture would no doubt relieve pressure temporarily, but whether its effects would be enduring enough to be of any practical value I am not prepared to say. Furthermore, lumbar puncture is in itself a dangerous procedure, and especially so in brain tumors. A number of sudden deaths have been reported as having been caused by this procedure.

As to the Question of Bulging of the Brain. If the most alarming feature of brain operation is hemorrhage, the most troublesome is the bulging of the brain that follows reflection of the dura. In the course of our operations Dr. Spiller and I have made certain observations bearing upon this subject. As a preface to these observations it should be stated that a distinction is made between the bulging which occurs immediately after the dura is reflected, which will for convenience sake be termed "initial" bulging, and that which manifests itself during the subsequent exploratory manœuvres, or "consecutive" bulging.

First, when a tumor is present there may be little or no initial bulging, but there is not likely to be any consecutive bulging. By this we mean that, given a case in which the tumor has been localized accurately and occupies the field bounded by the opening in the skull, there may be little or no bulging, even though the tumor be one of very considerable dimensions. In Cases II. and III. of this report there were present a small and a very large tumor respectively, and yet in neither case was there any initial or consecutive bulging. No doubt the character of the tumor would have some effect—thus a very vascular sarcoma would be more likely to bulge through the opening than a gumma. The release of pressure from a growth abounding in large vascular channels would result in a reactionary dilatation, more particularly of the venous channels, and this in turn might be followed by such circulatory disturbances as would readily lead to cerebral œdema. What we want to call particular attention to is this: that in the absence of bulging one must not be led to believe that there can be no tumor present.

Secondly, that when the tumor was not found, and if present was not situated at or beneath the area exposed, "consecutive" bulging was a very conspicuous feature, and the degree of bulging far exceeded the initial bulging observed when tumors were present. This at first thought seems as it were paradoxical, but upon further consideration is readily explained. It is due to the fact that normal brain tissue being the more sensitive reacts more rapidly to the insult of trauma-

[1] Beiträge zur Psychiatrie klinik, 1902, vol. i. p. 5.

tism. When the looked-for lesion does not present itself on the surface of the brain at the site of exposure certain exploratory measures are instituted: the brain is palpated to determine its consistency, exploratory incisions are made into the cortex to determine whether the growth is subcortical, and the exploratory needle is introduced in the search for deep-seated collections of fluid. Meantime the brain surface is subjected to the injurious influence of a comparatively low temperature. Each one of these exploratory measures inflicts a traumatism of greater or less degree, and, as a result of their combined effects, the brain swells with amazing rapidity, so that within a few moments it protrudes so beyond the dura that it becomes a physical impossibility to replace it sufficiently to unite the edges of the dural wound. The actual cause of the swelling is no doubt the development of œdema. As pointed out by Cannon, who conducted a series of experiments in order to explain the secondary increase of intracranial pressure in head injuries, the swelling and pressure are wholly independent of any increase of blood pressure whatever, and are the result of certain chemical changes in the brain substance itself, whereby the osmotic pressure is so increased that the brain rapidly becomes œdematous.

The practical lessons to be learned from these observations are easily foreseen. In the first place, have we not in this rapid and consecutive œdema a sign that the tissue presenting in the opening is chiefly normal brain tissue, and that if there be a tumor present in the region exposed it is in all likelihood a very small one? Secondly, these observations should teach us the importance of carrying out the exploratory measures in an expeditious manner. To be sure, we should not proceed with undue haste, but once the dura is exposed the various methods of exploration should be carried out in a methodical and unhesitating manner. A definite plan of procedure should be outlined before the operation begins, the instruments for exploration should be at hand, and once the dura is reflected the operator should, without a moment's delay, proceed with his investigation, and in the following order: 1. A careful inspection of the exposed cortex, noting whether pulsation is visible, whether the brain is of normal color, and noting the condition of the bloodvessels. Inspection should precede all the other forms of examination because soon after exposure of the brain to the traumatism inflicted by the examining finger the brain begins to bulge. The operator should palpate, gently of course, the cortex, both the part exposed and, if nothing abnormal be found there, the parts immediately surrounding. By palpation one can discover variations in consistency and in tension. V. Bergmann recommends in those cases in which the tumor cannot be felt that the patient be raised to a sitting posture, "whereupon the tumor may become visible or palpable, the area exposed sinking in somewhat from the atmospheric pressure in connection with the lessened blood pressure."[1] 2. If by palpation one discovers an in-

[1] Woolsey. THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, December, 1906.

crease in the consistency, and inspection fails to reveal a growth involving the cortex, an incision of from 1 to 3 cm. should be made in the direction of the suspected lesion. The importance of making more than a nick in the surface of the brain needs no explanation. In Case III., although the tumor would not have been removed at the first operation, it was not discovered, simply because the incision was not deep enough to expose it. 3. Failing to reveal the lesion, an exploratory needle, constructed especially for this purpose, should be introduced in two or three directions, but always through the same opening. The instrument best adapted to this purpose is a small cannula armed with a blunt obturator. The instrument should be introduced to the maximum depth, the obturator removed, and the instrument gradually withdrawn. The ordinary exploratory needle is useless, because upon its introduction the orifice becomes plugged with cerebral tissue, and the communication between a cyst or an abscess is thereby cut off.

Given a case in which the brain has bulged to a very considerable degree, how should this complication be treated? Three courses are open to the operator: the first to attempt to restore the brain to its normal confines and to close the dural wound; the second, to disregard absolutely the dura and to terminate the operation by closing the wound in the scalp; and the third, to make no attempt to replace the brain, but to repair the defect between the dural edges with a graft dissected from the pericranium. The adoption of one or the other of these three courses should depend upon existing conditions.

For purposes of illustration, imagine a case in which the tumor has not been found and in which there is an element of uncertainty in the diagnosis as to the existence of tumor. Under these conditions, if the dural edges cannot be approximated without such pressure upon the bulging brain as would lead inevitably to an undesirable amount of laceration of the brain substance, such a plan as that suggested by Keen should be carried out, namely, to dissect from the pericranium a graft large enough to fill the gap between the edges of the dura. This plan was adopted in Case IV. of this series. A diagnosis of tumor of the brain had been made, but instead of a tumor a tubercular meningitis almost confined to the parietal lobe was found. Shortly after the dura was reflected and the field explored the brain began to bulge in an amazingly and alarmingly rapid manner; to have attempted to suture the dura without removing a large section of the brain would have been a physical impossibility, and, inasmuch as there was no indication for the relief of pressure, the gap in the wound was closed in the manner as above described. As illustrating another phase of the question, picture a case in which a tumor was undoubtedly present, but had been localized inaccurately —a case in which headache was one of the conspicuous and most distressing symptoms. A radical operation in such a case is, for the time being at least, out of the question; but we have every reason to

believe that in relieving pressure the patient will enjoy a temporary period of relief. If, then, the indication is clearly to relieve pressure, it would be the height of folly to attempt to sew up the dura, as by so doing the intracranial pressure would be as great as it was before the operation. Under these circumstances the dura should be disregarded absolutely, the bone of the flap should be removed, and the wound in the scalp closed with great precision.

Palliative Operation. In every operator's experience there will be a certain number of cases which for one reason or another are not suitable for the radical operation, either because the tumor is inaccessible, or because it may be too large, or because accurate localization is impossible. Under any of these circumstances when the patient is suffering, evidently from the effects of increased intracranial tension—*e. g.*, headache, or choked disk—the palliative operation should be performed. I say "should be" because I believe an operation under these circumstances is more than a question of propriety; it should be regarded as imperative. Were it not for the headache the patient might enjoy for the rest of his days freedom from pain, if pressure is relieved. I have under my care now a patient that was referred to me by Dr. Hermance and Dr. Spiller, a patient who has unquestionably a tumor, but no symptoms sufficiently pronounced to make localization possible. He suffered from attacks of such violent headache that his reason became impaired; his suffering was intense and only to be compared with that attending the paroxysms of tic douloureux. Opiates did not relieve him. A section of bone was removed from the skull, and with but two exceptions, when the attacks were not severe and of very short duration, he has enjoyed absolute relief from pain, and is as contented and placid as one could be under the circumstances. The same gratifying effects may be obtained in cases of choked disk. When this condition has not existed so long as to have caused atrophy of the optic nerve an early operation for the relief of pressure will be followed by marked subsidence of or disappearance of the choked disk and by a corresponding improvement of vision. We are thus enabled to restore to a greater or less degree the patient's vision for the remainder of his life. In a case recently operated upon the effect of craniotomy and consequent relief of pressure was very strikingly illustrated. The choked disk, which was present to a very marked degree, subsided at least one-half within three weeks of the date of the operation. Unfortunately in this case the operation was not performed soon enough to save the patient's vision, as very marked atrophy of the optic nerve had already occurred. For the relief of these two conditions, namely, headache and impairment of vision, I lay stress upon the importance of the palliative operation. In performing this operation a section of bone representing about three square inches should be removed and a dural flap fashioned and reflected, and the wound in the scalp closed. This will afford the desired relief of tension.

RESULTS. As to the more recent statistics upon the results of surgical intervention for cerebral tumor, Woolsey[1] has collected 101 cases of cerebral tumors which have been operated upon during the past five years. Of this series he says: "Twelve cases, 11.8 per cent., died within twenty-four hours, and twenty-six, or 25.7 per cent., within three weeks." Here at once we see a very marked reduction in the immediate mortality. Von Bergmann regards 25 per cent. as a very conservative estimate of the number dying as the direct result of the operation. Of the eighty-eight cases of Woolsey's series, of which an exact localization was made, the mortality was but 22.7 per cent., as against 46 per cent. among those not exactly localized. In Gussenbauer's series of twelve cases there was but one death, and that due to pneumonia. "As to the more remote results, six died within three weeks and three months; nine between three months and one year, and three between one year and two years. As almost all of these died from the effect of the tumor the mortality within two years is 43.5 per cent." This high mortality, both immediate and remote, Woolsey says is not greater than that following radical operations for malignant growths in some other situations, and that considering "the otherwise hopeless condition of these cases, the difficulties of exact diagnosis, the inaccessibility of the tumors, and the marked relief of symptoms in almost all cases not dying at once, we may take courage and feel some degree of satisfaction." Woolsey says "that we should feel still more encouraged when we consider the length of time during which some cases remain free of recurrences. Cases of sarcoma are reported four years, four years and one month, five and one-half years, and eleven years after operation. A case of fibroma was reported well eight years, cases of gummata two and one-half years, a case of glioma three and one-half years, and one case, in which the variety of tumor was not given, nine years after the operation. Seven cases of sarcomata are reported to have recurred at periods ranging from three months to eleven years, and averaging two years and four months, or, exclusive of the latter case, nine and one-third months."

It is needless to say that the prognosis in the case of benign tumors and cysts and in cases of well-encapsulated sarcomata is much better than in operations when the growths are of malignant and infiltrating type.

RESUME. 1. All measures recognized as prophylactic of shock should be observed stringently. In these we have the most effectual means of reducing the mortality. The most important of them are (*a*) the avoidance of prolonged operation; (*b*) the prevention of excessive hemorrhage, and (*c*) the avoidance of unnecessarily rough manipulation of the brain substance.

2. A given area of brain can be exposed with the least minimum degree of traumatism and greatest economy of time by the electric engine.

3. Temporary closure of the carotids in operations upon the brain is ineffectual and not unattended by danger. It should be reserved for extreme cases, and practised on one side only.

4. Observations should be made upon the blood pressure immediately before and at frequent intervals during the operation. Object of same twofold: (*a*) as the most reliable index of patient's condition; (*b*) as the only exact method of determining whether operation should or should not be carried out in two stages.

5. Two-stage operation is indicated when there has been a decided fall in blood pressure after the relief from intracranial tension, such as follows reflection of the Wagner flap and dura.

6. Lumbar puncture as a means of relieving pressure is a temporary, not to say dangerous, procedure.

7. Bulging of the brain is one of the most embarrassing features of cerebral operations. A distinction may be made between that which occurs immediately after reflecting the dura, "initial" bulging, and that which follows as a result of subsequent exploratory manipulation, "consecutive" bulging.

8. "Initial" bulging is due to the increased tension exerted by a tumor. It is not always present, is often not excessive, and is not likely to be followed by "consecutive" bulging.

9. "Consecutive" bulging is due to the cerebral œdema set up in normal brain tissue by trauma inflicted by the exploratory manipulations. "Consecutive" bulging far exceeds in magnitude initial bulging, and suggests the absence of a tumor of considerable size at the seat of operation.

10. In order to avoid this "consecutive" bulging, which is a most embarrassing feature of these operations, exploration should be carried out in the most expeditious manner.

11. When the edges of the dural wound cannot be approximated without undue tension or without great laceration of brain substance, the gap should be closed by a graft taken from the pericranium, providing the tumor has not been found and there is reason to question the accuracy of the diagnosis.

12. When there is every assurance of a tumor being present, but it proves to be inoperable or was imperfectly localized, no attempt should be made to close the dura, as in so doing the best possible palliative effects of the operation would be counteracted.

13. Palliative operations should be regarded not merely as operations of propriety, but should be considered imperative whenever the tumor cannot be found or cannot be removed.

14. A statistical study of the results of the last five years is encouraging. The mortality, both immediate and subsequent, has been reduced materially. Recurrence after operations for malignant growths of the brain is no greater than after operations for malignant growth of other structures.

Resume of the Operative Records.[1]

Case II.—*G. K.; operation May 2, 1903; osteoplastic resection of the skull; exposure and removal of cortical sarcoma; recovery from immediate effects of operation; marked improvement in patient's condition during a period of several weeks; return of the growth, with fatal termination.*

Upon reflection of the osteoplastic flap and dura an area was exposed to view which, to the touch and sight, was unquestionably pathological, and proved to be the tumor. Before proceeding to remove the tumor, consideration was taken of the patient's condition, and more particularly of his circulation. If from the effect of the preliminary procedures the patient's circulation had been depressed, further manipulation would have been postponed for twenty-four to forty-eight hours, or until the circulation was re-established. In the absence of any alarming evidence of depression, the operation was continued and the tumor removed. There were no technical difficulties nor hemorrhage attending this step of the operation.

The tumor was not situated in the centre of the area which was exposed, but quite near the margin of the opening, so that if the opening in the skull had been a small one it is quite possible that the tumor might have escaped the eye of the operator.

At the end of the operation the patient's temperature was 96° F., his pulse 92, and his respirations 28. The patient reacted quite promptly, and at no time did we entertain doubt as to his recovery from the immediate effects of the operation. On the evening of the operation there was complete paralysis of the right arm and leg, and aphasia; but the following morning the function of both limbs was partially restored and the patient could speak, but very indistinctly. On the fifth day a very decided improvement was observed, both in the size of his vocabulary and in the rapidity with which he could give expression to his thoughts. Generally speaking, there was a decided improvement over his condition before the operation. The headache of which he had complained so bitterly was almost entirely relieved. Occasionally he complained of a soreness in his head, but the constant distressing headache so characteristic of brain tumor had disappeared. Two weeks after the operation he left his bed, and would have been discharged from the hospital had it not been thought desirable to keep him under observation for a longer period.

Case III.—*Thomas S., aged forty-seven years; operation June 5, 1903; osteoplastic resection of the skull; subcortical tumor below the surface of the brain within the white matter; not found because of its deep situation within the substance of the brain; operative recovery; death thirty-four days after the operation.*

After preliminary closure of the carotids the osteoplastic flap and

[1] Editorial Note.—The clinical histories of these cases appear in full in the article by Dr. Spiller in this number of the Journal.

its dura were reflected and the brain exposed. When the dura was divided the brain did not protrude, as it so often does. Its surface was inspected and several gross lesions were noted in the field exposed. These lesions were quite superficial and were not sufficiently intense to explain the symptoms. Several incisions were made into the cortex of the brain about a centimetre in depth, with a view toward exposing a subcortical growth, but the incisions were not deep enough to have revealed the tumor which was discovered at the autopsy. The flaps were replaced and the wound closed. In this, as in the former case, the patient reacted promptly from the operation, and after a slight febrile reaction, running over a period of eight days, the temperature returned to normal. During the convalescent period the patient had some convulsions, Jacksonian in type, and his left upper limb became almost completely paralyzed. He was, however, almost entirely relieved of the headache from which he had been suffering. He was transferred to Dr. Spiller's ward three weeks after the operation.

CASE IV.—*F. F.; operation June* 23, 1903; *osteoplastic resection of the skull; exposure of multiple tubercular tumors (meningitis en plaque) of the parietal lobe; removal of growths impossible.*

Several observations upon the blood pressure were made prior to the operation, and, as is now my practice, these observations were continued at intervals of not less than five minutes throughout the operation. Anticipatory of hemorrhage, both common carotids were closed temporarily. A horseshoe-shaped flap composed of the scalp was fashioned with the knife of the Stellwagen instrument and the bony flap with the drill and dental engine. Upon attempting to reflect the dura numerous adhesions were discovered between it and the cortex, but these were separated without much difficulty. Upon reflection of the dura numerous lesions, some isolated, some confluent, were revealed distributed over the entire area of the cortex which had been exposed to view. Upon introducing my index finger between the dura and exploring the cortex in all directions, I discovered more adhesions. The discovery of the latter was sufficient to warrant the assumption that the process was too diffuse and of such a nature as to render it positively inoperable. Although the manipulations had up to this time been neither prolonged nor of such a character as to inflict serious traumatism upon the cerebral tissue, yet the brain had bulged to such an extent that it became quite evident that I would not be able to bring the edges of the dura into apposition. In order to guard against the development of a hernia or a fungus cerebri, a section of pericranium was removed of a size sufficient to fill in the gap in the dural wound. Within a few minutes of the time the brain was exposed, although nothing more than a careful inspection and exploration with the finger had been resorted to, the circulation began to fail, becoming more and more depressed until the termination of the operation, when the pulse was

weak and the blood pressure alarmingly low (75). His condition for the first forty-eight hours was critical, but in the third day improved to such an extent that I began to feel more hopeful of his recovery from the operation. This reaction was only temporary, however, as œdema of the lungs rapidly developed, and on the fourth day after the operation the patient died.

CASE V.—*W. C. H.; tumor of right cerebellar lobe at its union with the pons; operation July* 23, 1903; *craniotomy of the cerebellar fossa; second stage of operation (opening of dura and exploration for tumor) postponed because of patient's serious condition.*

Realizing the difficulty with which all the surfaces of the cerebellum are exposed through a small unilateral opening and anticipating very free hemorrhage, not only from the scalp but from the diploic sinuses, I decided before the operation to secure a better opportunity to examine the suspected hemisphere by making a very liberal opening in the skull, one extending from one side to the other, and to control at least some of the hemorrhage by preliminary but temporary closure of the carotids. Proceeding along these lines, after the Crile clamps had been applied to the carotids I fashioned a horseshoe-shaped flap by making an incision from one mastoid process to another parallel to and 1 cm. above the superior curved line. After clamping the bleeding points in the flap, an opening in the skull was made with chisel and mallet 2 cm. below and 2 cm. from the median line. This opening was enlarged with the rongeur forceps equally in all directions until it extended above to the superior curved line and almost to the median line. A similar opening was made in the opposite side. By means of a Gigli saw the intervening bridge of bone was divided above and below and removed. With this the first stage of the operation was completed. The patient's condition at this time was such as to make it unwise to proceed to search for the tumor. From the beginning of the operation there was some evidence of impairment of the respiratory or circulatory function, perhaps both. This may or may not have been due to the anæsthesia (ether), to the loss of blood, to the fact that the position of the patient may have embarrassed respiration. At all events, he was more or less cyanosed throughout, and when the first stage of the operation was completed his pulse was very rapid (170 to 180), although his blood pressure was high (158). Immediately after his recovery from ether it was noted that he was hemiplegic. During the night his respirations were of the Cheyne-Stokes type, and there were some twitchings of the left side of the face. On the following morning, at 9 o'clock, his pulse reached its lowest rate (120), but from that time on until the patient's death, thirteen hours later, the pulse and temperature began to rise. The last registration was: pulse, 180; respiration, 24; temperature, 103.8° F.; blood pressure, 90.

REVIEWS.

DISEASES OF THE SKIN: THEIR DESCRIPTION, PATHOLOGY, DIAGNOSIS, AND TREATMENT, WITH SPECIAL REFERENCE TO THE SKIN ERUPTIONS OF CHILDREN, AND AN ANALYSIS OF FIFTEEN THOUSAND CASES OF SKIN DISEASE. By H. RADCLIFFE-CROCKER, M.D. (Lond.), F.R.C.P., Physician for Diseases of the Skin in University College Hospital; Honorary Member of the American Dermatological Society; Membre Correspondant Etranger de la Société Francaise de Dermatologie, etc. Third Edition, revised and enlarged, with 4 plates and 112 illustrations. Philadelphia: P. Blakiston's Son & Co., 1903.

THIS new edition of Dr. Crocker's well-known work on *Diseases of the Skin* is a ponderous volume of almost 1500 pages, one-half larger than the previous one, convincing evidence of the author's industry and of the great activity prevailing in this particular field of medical research. Marks of careful and judicious revision are visible in every part of the book, which has been thoroughly brought up to date. Many new articles have been added, among the most important of which are those upon *x*-ray Dermatitis, Toxin Serum Eruptions, Porokeratosis, Sarcoid, Leukæmia and Pseudoleukæmia Cutis, Endothelioma Capitis, Hydrocystoma, Acne Necrotisans, Folliculitis Decalvans, and Blastomycosis Hominis. The excellent plan of putting in small type matters of minor importance has been followed in this, as in former editions.

After giving a definition of eczema, the author proceeds to make clear what forms of inflammation of the skin he includes under this term, a quite necessary step, owing to the increasing confusion among recent writers as to just what is meant by eczema. He excludes all forms of seborrhœic dermatitis as well as those due to strong irritants, but he also calls attention to the fact that certain substances which are commonly innocuous may, in certain individuals, produce a dermatitis indistinguishable from eczema, and for this and other reasons it is best to consider such inflammations among the forms of eczema. In the treatment of this oftentimes very obstinate disease turpentine internally, in 10-minim doses, is recommended as very beneficial in uncomplicated cases, care being taken to accompany it with large quantities of some diluent to avoid irritation of the genito-urinary tract. In those cases characterized

by frequent exacerbations counterirritation over the nape of the neck or in the lumbar region, in the shape of dry heat or mustard plasters, has been found extremely serviceable by the author in promptly relieving the itching.

In recent years the view that lupus erythematosus should be ranged among the diseases due, directly or indirectly, to tuberculosis has been gaining ground; but Crocker is not at all inclined to accept this view. He believes the affection is "primarily a vasomotor disturbance leading to an inflammation of the skin, perhaps of toxic but not of tuberculotoxic origin, especially predisposed to by a feeble blood current," with secondary microbic invasion.

Unna's view that psoriasis is but a part of the seborrhœic process obtains no support from the author, who believes it is most probably due to a microparasite which finds a suitable soil only in certain individuals. This organism probably at first attacks the skin; but its rapid spread and wide distribution are best explained by supposing that it penetrates the circulation later, and is distributed by the blood current.

The colored plates representing the principal syphilides which have been added to this edition will afford but indifferent aid in diagnosis, since they are anything but accurate representations of the lesions they are supposed to depict.

The enviable position which this treatise at once assumed upon its first appearance is easily maintained by this edition, and the student, the general practitioner, and the specialist will find it an accurate and complete presentation of the subject of dermatology, useful alike as a text-book and as a work of reference. M. B. H.

NURSES' GUIDE TO SURGICAL BANDAGING AND DRESSINGS. By WILLIAM JOHNSON SMITH, F.R.C.S., Principal Medical Officer, Seaman's Hospital, Greenwich. Philadelphia: J. B. Lippincott Co. London: The Scientific Press, Limited.

THIS is a good book badly named—one that any nurse can read with advantage. It is an excellent, handy pocket manual on surgical nursing with a title in part too modest, yet otherwise misleading. It is not with bandaging that the greater number of these pages deal, but, adapted to the needs of nurses, they contain a concise, plain, and sufficient statement of the pathology and treatment of wounds, ulcers, burns, infection, and sepsis; also of the principles and comprehensively of the practice of asepsis, antisepsis, and of special surgical nursing, and a useful chapter on splints. Of all this the cover fails to hint.

A subordinate part of the book, a couple of chapters on bandaging, through being alone honored in the title, unjustly forces comparison

with works devoted solely to this topic, notably an ideal one by an American author and from the press of the same publisher. Judged by this standard, it cannot escape harsh criticism on the score not only of incompleteness, but of insufficient illustration of the bandages described.

Had the title of this attractive little book indicated that it was a manual on surgical nursing and dressings with hints on bandaging, it would not challenge criticism, but invite praise and more than honor the promise of its back. J. M. S.

HYPERÆMIA AS A THERAPEUTIC MEASURE (HYPERAMIE ALS HEILMITTEL). By PROF. AUGUST BIER, of Greifswald. Leipzig: F. W. C. Vogel, 1903.

PROFESSOR BIER has been animated by two facts in his endeavors to gain for hyperæmia a permanent place in therapeutics—that hyperæmia is one of nature's great remedial agents, for it is a well-established observation that every diseased process which the body itself attempts to cure immediately becomes surrounded by an area of hyperæmia; and that physicians should be under obligations to imitate those natural processes by which the organism is constantly combating the inroads of disease.

He divides his book into two parts. In the first he discusses active or arterial hyperæmia, and passive or venous hyperæmia, and also the methods for the practical application of these. Hot air and vacuum apparatus, the constricting bandage, and dry cupping are described, and in a separate chapter the physiological action of dermal irritants is fully discussed. Another chapter is devoted to the description of the analgesic, bactericidal, absorbent, dissolving, and nutrient actions of hyperæmia. The second division of the book is taken up with the consideration of the methods and results of the treatment of various diseases by means of induced hyperæmia. Tuberculosis of the joints is first discussed. Here passive hyperæmia only can be employed, as the more pronounced active form can effect great harm. Bier recommends the procedure perfected by Tillmann, which consists of applying a constricting bandage for one hour daily sufficiently tight to induce a well-marked passive hyperæmia. There should be no pain from this, and the appearance of red blotches on the skin must be avoided. It is not necessary to bandage the parts on the peripheral side of the elastic bandage, nor is it essential to apply the constricting band immediately above the diseased joint. Thus in tuberculosis of the joints of the hands or feet the elastic bandage may be readily applied on the upper arm or the thigh. Cold abscesses should be evacuated through a small incision and the compression commenced two or

three days later. If abscess formation comes on during treatment, an incision is likewise made and the treatment interrupted for a few days. The fistulous tracts close quite readily and Bier has also observed the expulsion of bone sequestra during the time of treatment. Permanent fixation as a routine is not recommended, but, on the contrary, active and passive movements are begun as soon as possible. In this way Bier was able to cure cases of joint tuberculosis which experienced surgeons had designated for primary amputation.

The author of the book believes that this is the most conservative method in the treatment of joint tuberculosis, which is followed by good results without the slightest danger, and with which the function of diseased joints can be restored in a manner superior to all other conservative procedures. The method is, however, not infallible, and the condition of the patient's blood undoubtedly plays an important rôle in the success of the process.

The acute gonorrhœal inflammations have also been most favorably influenced by passive hyperæmia. Here it is necessary to apply the elastic bandage for somewhat longer periods, at least ten to twelve hours daily. The analgesic effects are particularly well marked; it is possible to move joints both actively and passively after the bandage has been in place for a short time, in which motion had previously caused most acute pain, and the wished-for sleep soon follows. In some cases the method failed, but fortunately the best results were secured in the worst cases. Bier also treated with excellent outcome instances of acute articular rheumatism and also certain inflammations of the soft parts, such as erysipelas and some varieties of phlegmonous processes, but in the latter case the author advises caution and abandons the method unless an immediate result is achieved.

Active and passive hyperæmia are both of undoubted value in the treatment of chronic articular inflammations and their consequences. In these cases the vacuum apparatus accomplishes good results. The general procedure is as follows: application of hot air daily for one hour, use of the vacuum apparatus once or twice daily for twenty to thirty minutes at a time, compression with the elastic bandage for eight to twelve hours a day, and massage and elevation of the limb during the interim.

Treatment with hot air, because of the absorption induced by the hyperæmia, has a favorable effect in removing the œdema which often results after the healing of fractures. It was also used with gratifying results in a case of elephantiasis of the leg. Mention must also be made of the fact that neuralgic pains are benefited by active hyperæmia, and headaches, especially those accompanying an anæmia, by passive hyperæmia produced by the application of a rubber bandage around the neck.

The book is the result of most careful observation and is based

on the author's personal experiences in over one thousand cases of various diseases where positive and favorable effects were obtained by this method of treatment. In this country but few physicians have made such extensive trials of these measures, and the good results obtained by Professor Bier with this method should animate others to make further experiments and to add their knowledge gained to this interesting department of therapeutics. S. E. J.

HIGH-FREQUENCY CURRENTS IN THE TREATMENT OF SOME DISEASES. By CHISHOLM WILLIAMS, F.R.C.S. EDIN., etc. London: Rebman, Limited, 1903.

IN this work the author offers "a short account of the treatment of some diseases by means of electric currents of high frequency and high potential." The main source of the account is given as from the author's own practice, supplemented by selections from "diverse journals not readily accessible to the busy practitioner." His experience with the therapeutic use of these currents dates from 1898, and in his introduction he at once arouses interest by stating that high-frequency currents "have been proved to produce extraordinary and peculiar results in the alleviation of some diseased conditions."

Certainly the uniformly excellent results secured by him in "atonic dilatation of the stomach—results far in advance of those obtainable in the same length of time by any other therapeutic agent—stir up hope that here is a form of treatment worthy of extended trial. The scope of the work includes a discussion of the different "sources of energy," of various apparatus, of the properties of the currents from physical and physiological standpoints, and lastly a consideration of therapeutic methods.

While we agree with the statement that a "certain amount of elementary electric knowledge is necessary," we cannot recommend the "elementary electrophysics" which the author gives as being either accurate or useful. The following archaic view of what takes place in a primary battery when the external circuit is closed will serve as an illustration: After describing a cell in which plates of copper and zinc are immersed in dilute sulphuric acid, he goes on to state, "When the electricity generated is allowed to circulate externally by joining the plates one notices that on each plate gas bubbles are formed from the electrolytic decomposition of the water, hydrogen and oxygen being liberated, and these bubbles interfere more or less with the chemical activity between the liquid and the metals, so that the E. M. F. and with it the tension tend to rapidly decrease; this action is termed polarization."

Now, the oxygen and hydrogen gases set free at the electrodes

are obtained as the result of a secondary action in the dilute sulphuric acid (the electrolyte): in this, while the hydrogen is set free at the kathode, the negative ions of SO_4 decompose the water at the anode and combine with its hydrogen to form hydrogen sulphate and set the oxygen free; the term polarization refers to the production in the cell of an electromotive force counter to the normal one.

Under the head of Sources of Energy are discussed primary and secondary batteries, commercial electric mains, and static machines. The author's description of a static machine is not applicable to the associated cut on page 42, which is directly referred to. The machine is stated to "produce electricity by friction," whereas it is really generated by induction, the difference of potential existing between the disks at rest being increased by rotation.

In the chapter devoted to the description of apparatus the "elementary electrophysics" is of a nature to arouse interest. We quote as a sample from page 105: "Most of us have seen the experiment of two tuning forks tuned to the same pitch giving the same harmonic. If one be vibrated by a blow or by the fingers the second fork will start vibrating by itself and give off the same harmonic; because it is syntonous or vibrating in unison with the former, it will reinforce the sound given by the first vibrator." Now, the tone of the tuning fork is a practically simple one—*i. e.*, a fundamental one—the overtones being inappreciable, and therefore the term harmonic is inaccurate; the second tuning fork *responds* to the tone of the first; it does not reinforce. This is based on the well-known principle of sympathetic vibrations.

The book will prove of interest to electrotherapeutists for the reason that it gives the opinions of a man of considerable practical experience as to the selection and use of the apparatus essential in the production of high-frequency currents. H. M. W.

A Text-book of Diseases of Women. By Barton Cooke Hirst, M.D., Professor of Obstetrics in the University of Pennsylvania; Gynecologist to the Howard, the Orthopedic, and the Philadelphia Hospitals. Pp. 683, with 655 illustrations, many of them in colors. Philadelphia, New York, and London: W. B. Saunders & Co., 1903.

Dr. Hirst has been a consistent advocate of the opinion entertained in Germany that obstetric and gynecic surgery should always be combined. The present work, he announces in the preface, is "a companion volume to the author's *Text-book of Obstetrics*, the two volumes covering the whole subject of gynecology." Knowing as we do his unusual experience in both branches, as well as his high reputation as a teacher and indefatigable worker, we are prepared to find his latest work a valuable addition to the literature.

The section on diseases and injuries of the vagina, includes nearly seventy pages, with no less than sixty cuts, nearly all original. We note several pages on the treatment of gonorrhœa and an excellent description of the manner in which the pelvic floor is lacerated during labor. The author rightly believes that only by understanding how the injury occurs can one recognize afterward the exact nature of the lesion and the indications for operation. The detailed description of complete laceration, admirably illustrated, deserves careful study. The writer's conservatism is indicated by his adherence to the use of pessaries for cystocele. His operation for the cure of this condition is certainly an advance on the usual oval and circular methods of denudations. As he rightly says, Martin's operation "does not unite the torn muscles which should support the lower anterior vaginal wall and the urethra, and therefore it is not always permanently successful."

The writer prefers Emmet's operation for the repair of laceration of the pelvic floor, which is thoroughly described and fairly well figured. He uses silkworm-gut in all his plastic work, his experience with chromicized catgut being less satisfactory than that of most operators. We must take exception to some of the illustrations (especially Figs. 196–198), which are more intelligible to the expert than to the tyro.

Injuries of the cervix are profusely illustrated, unnecessarily so, the critical reader may think. We are thoroughly in accord with the statement that "whenever one is in doubt as to the suitable form of operation, it is better to decide on an amputation." Figs. 228 and 229 do not bring out with sufficient clearness the depth and extent of the denudation. Silkworm-gut is preferred for trachelorrhaphy, a conservative practice which is opposed to that of most gynecologists, who obtain equally good results with chromic gut, while the patient is spared the pain and annoyance consequent upon the removal of sutures while the perineal wound is still weak and sensitive.

The section on carcinoma is excellent. There seems to be no good reason for confusing the student by adding "malignant adenoma" as a separate variety. The paragraphs on symptomatology and diagnosis are clear and concise. Some of the illustrations, though excellent in themselves, might be dispensed with.

In common with recent views, the author prefers abdominal to vaginal extirpation, or rather the combined method, although from his description it is not clear what advantages he gains, since he does not advocate routine removal of the lymph-nodes. His lucid descriptions of surgical operations are well exemplified in the pages devoted to the technique of hysterectomy.

His conclusions with regard to prognosis after operations are fair and conservative, his immediate mortality after vaginal and com-

bined hysterectomies being 7 per cent., while four of his patients were known to be alive at the end of five years.

We are glad to note that the author still believes in the non-surgical treatment of uncomplicated retrodisplacement, and does not reject the use of tampons in adherent retroflexion. In this he is, as ever, a safe guide to the student, who is only too apt to infer that so-called medical gynecology is a thing of the past. The descriptions of the use of pessaries and of Alexander's operation (he prefers Edebohls' method) are especially good. He seems to have had better results from plastic operations alone, with accompanying ventrosuspension, than have most of his confrères. He does not favor the recent vaginal operations of Wertheim, Freund, and others.

The section on fibromyomata and operations for their removal is ample and is beautifully illustrated. The same applies to the sections on endometritis and malignant disease of the endometrium. One is rather surprised to miss any reference to deciduoma malignum. The Fallopian tubes form the subject of Part VIII. Here, again, some of the cuts are superfluous. One characteristic illustration of each of the diseased conditions would be sufficient. The paragraph on the preventive treatment of tubal disease (pages 415–416) ought to be read by every layman, as well as physician. The author rightly believes that the palliative treatment of salpingitis should receive a fair trial before resort is had to an operation.

The section on extrauterine pregnancy is, as will be inferred from the writer's wide experience, up to date. The criticism might be offered that too little stress is laid upon the difficulties of diagnosis in many cases, as every gynecologist has experienced in his own practice. Explorative vaginal section deserves mention. The author is apparently one of the few operators who still use the old-fashioned glass drainage-tube. He states that he now rarely irrigates the abdominal cavity except to remove blood-clots after operations for ectopic gestation. The description of the operation for intraperitoneal rupture (page 441) is a model of terse writing.

Part IX., on diseases of the ovaries, leaves little to be desired. The cuts are many and original and the technique of ovariotomy most satisfactory.

Upward of fifty pages are assigned to diseases of the urinary tract, cystoscopy and catheterization of the ureters being carefully described. Ten are devoted to floating kidney, an innovation in a work on diseases of women, doubtless in deference to the especial interest which gynecologists have taken in this subject, much to the distaste of the general surgeon. We are pleased to note that the author does not subscribe to the indiscriminate practice of performing nephropexy on slight indications, since he found it necessary to operate in only 5 out of 200 cases.

The excellent concluding chapter on the technique of gynecic

surgery in quite a model in its way, the lucid descriptions being illustrated by over 100 figures. Nothing has been omitted to furnish a safe and trustworthy guide to the beginner. It serves as a true index of the careful, conscientious work which distinguishes the author.

We have been unable in this brief review to do justice to this the latest work on gynecology. Our object has been rather to stimulate the reader to make a careful study of it for himself. While a critical reviewer might take exception to some minor defects, we are so impressed with the honest conservative tone maintained throughout, and with the fact that it is based entirely upon the personal experience and convictions of the writer, that we have only commendation for this fresh product of his wonderful industry. We have already called attention to the number and beauty of the illustrations, and to the clear, common-sense manner in which each subject is treated. While we are not prepared to admit that the present book is equal to the companion *Text-book of Obstetrics*, the fourth edition of which appears simultaneously with it, we have no doubt that it will achieve the same widespread popularity, which is all that the most ambitious author could desire. H. C. C.

GYNECOLOGY. A TEXT-BOOK FOR STUDENTS AND A GUIDE FOR PRACTITIONERS. By WILLIAM R. PRYOR, M.D., Professor of Gynecology in the New York Polyclinic Medical School; Attending Gynecologist to the New York Polyclinic Hospital; Consulting Gynecologist to St. Vincent's Hospital, New York City Hospital. Pp. xvi., 380, with one hundred and sixty-three illustrations. New York and London: D. Appleton & Co., 1903.

THE preface of this excellent book indicates clearly its purpose, which is to present the subject in such a practical, dogmatic way as "a professor of gynecology in any of the colleges has to lecture." Rare diseases, bacteriology and minute anatomy, and "matters which strictly belong to other branches of medicine" are accordingly omitted.

We have not been disappointed in our favorable anticipations. Dr. Pryor has not only succeeded in writing a readable book, but one which in many respects is in a class by itself. At the outset we note with approval its division into two parts, the first, including nine chapters, being devoted to diseases and non-surgical treatment; the second to descriptions of the various gynecological operations.

In the introductory chapter on examination of the patient there are several useful practical hints with regard to the proper practice of the bimanual, important points being emphasized in large type. The illustrations are few, but satisfactory, unless we except the cut showing Trendelenburg's position, in which the elevation is extreme,

at least for most American operators. The writer still prefers Sims' position for examination and minor operations.

With Chapter II. (pages 14 to 68) we are introduced at once to the subject of inflammation, beginning with vulvitis and concluding with oöphoritis. The important subject of gonorrhœal infection receives especial attention, in quite sharp contrast to the superficial way in which it is treated in most text-books. If space permitted we would like to quote several of the italicized sentences. The pages on gonorrhœal and septic endometritis deserve careful study, since they contain an unusual amount of information condensed within a small compass.

The much-vexed subject of metritis is disposed of with less verbiage and clearer insight than is the case with most writers, for which students will feel devoutly thankful, however one may differ from the author's radical views. Peritonitis receives careful attention, twelve pages being devoted to it. With the conclusion that "peritonitis is an exponent of an infectious process rather than a disease *per se*," few, if any, will dissent.

Salpingitis (another subject which has been rendered unnecessarily complicated to the student) is happily elucidated. We note in passing one of the many dogmatic statements in large type which often arrest the reader's attention and present in a few words the gist of the treatment of pyosalpinx, viz., "Suppuration in a preformed sac is cured either by removal of the sac or by its obliteration."

The concluding section on inflammations of the ovaries is another example of the process of condensation, which may not always suit the pathologist, but certainly will relieve the student's perplexity. Here again the writer shows that he holds decided views and is not afraid to express them. Referring to ovarian sclerosis (a better term, by the way, than the common "cirrhosis"), he affirms that "as the symptoms produced by such a condition are so little understood, sclerosed ovaries should never be removed unless the uterus also needs to be sacrificed."

We agree heartily with the statements that "there is no standard of gross appearance to guide the surgeon in his operations upon the ovaries," and that "few symptoms are produced by ovarian inflammations which are not easily referable to associated diseases."

Chapter III., on "Distortions and Displacements," is on the whole quite satisfactory, although some of the statements may be questioned, notably this, that "the ligaments play no part in maintaining the uterus in position until their uterine attachments are rendered tense by displacement of the uterus." The author's views with regard to the treatment of anteflexion are well known. Those on retrodisplacement are sound. Believing, as he does, that "not so much the displacement as the accompanying or causative lesions produce the symptoms," he would naturally emphasize his opinion that "there is too great a tendency in the profession to perform

operations for retrodisplacement without employing less severe methods first." This is sound teaching for the modern medical student, who is in danger of forgetting that gynecology is not synonymous with surgery.

Sections on laceration of the cervix and perineum seem rather out of place in this chapter. The writer assigns less importance to cervical tears than other authors, not regarding this lesion as the cause of sterility, abortion, or reflex nervous symptoms, while he admits that it is a direct etiological factor in the production of cancer. In common with most gynecological surgeons, he finds that amputation is indicated much more frequently than trachelorrhaphy.

Under Chapter IV., on Diseases of the Vulva, are included diseases of the vagina and cervix, a confusing arrangement, especially as the concluding subject under cervical conditions deals with vaginismus (?). Doubtless the author will see the propriety of a rearrangement of the subject-matter in a subsequent edition, or at least a change in the heading. The important subject of pruritus deserves a place here instead of the brief mention which it receives on page 17 under the section on Bartholinitis.

Genital fistulæ are well treated in Chapter V., though here again we note with surprise the appearance of a sub-heading on "Diseases of the Urethra and Bladder," with no less than eight pages on the ureters, a disproportionate amount of space, it would appear, in a work intended for students and practitioners, for whom the subject presents rather a scientific than a practical interest. The whole subject of diseases of the urinary tract is handled in a satisfactory manner, and we note with approval the author's original work in this field, with which the profession is already familiar.

Chapter VIII., on Cancer, is one of the best, especially the paragraphs on symptoms, which are expressed in a terse, dogmatic way well calculated to impress them upon the mind of the student. The writer thinks that the first symptom is "an increase in that leucorrhœa which the woman habitually has," bleeding being a subsequent indication. Contrary to usual observations, he does not find that menorrhagia is present. In referring to the examination of scrapings in suspected cancer of the body of the uterus he emphasizes the fact too often lost sight of, that "the positive evidence furnished by the curette and microscope is infallible, but the negative by no means shows that cancer does not exist."

With Chapter IX. we enter upon the second part of the book, where the author is entirely at home. Operations on the cervix are first considered, beginning with dilatation and curettage, and concluding with amputation. Perineorrhaphy receives careful attention. We note with some surprise that the author still uses silver wire, and does not move the bowels until the seventh day, which accounts for the statement that it may be necessary to break up hard fecal masses with a dull curette (!).

Contrary to the general opinion with regard to Pryor's radical

methods, he is an advocate of conservative operations on the adnexa, while recognizing justly their limitations. The introductory paragraph under Chapter XV. represents a common-sense view of this much-discussed question. An interesting presentation of his opinions on vaginal section and drainage in acute salpingo-oöphoritis and acute pelvic peritonitis will be found on pages 279 and 280. The operation may strike the ordinary reader as revolutionary, but if the writer is right, "it is not only conservative, but is curative."

In Chapter XVII. there is a clear description of the author's radical operation for pelvic suppuration, with the details and remarkable results of which gynecologists are already familiar. The accompanying cuts are excellent. In the chapter on removal of the cancerous uterus the writer begins with the propositions that "no radical operation should be attempted unless the section of the tissues can pass outside the cancerous field," and that "the merits of an operation for the relief of this condition are determined by the ultimate results rather than by the immediate." He prefers the abdominal method of extirpation, since after vaginal extirpation 60 per cent. recur within the first year.

Chapter XIX. deals with various subjects, viz.: hernia, cystotomy operations during pregnancy, and a short section on the results of castration; Chapter XX. with hæmostasis, and the concluding chapter with the operative treatment of anomalies of the genitals. Following these is a "song without words," headed Chapter XXII., which includes five pages filled with cuts of instruments, without accompanying text.

We have reviewed in a most superficial way a work which deserves careful perusal if for no other reason than it is an honest book, written by an honest man. We may dissent from some of his views and may think that his tone is often too positive and dogmatic, but we cannot deny the virility and originality which characterize his exposition of them. Looked at from a critical standpoint we cannot regard the arrangement of the book as free from faults, since the sequence is often interrupted, and there is not that natural coherence which one looks for in a scientific work. But the book must obtain prompt and widespread recognition by reason of its intrinsic excellence. The style is condensed, but never to the point of obscurity. There is no padding and no borrowing from mediæval sources, but it is essentially an exponent of personal observation. There is no doubt that the circle of readers will be larger than the author modestly hopes, for he may be sure that it will "interest even those of large experience."

When we add that the drawings are mostly original and that they are reproduced with that beauty for which the well-known firm of publishers is famous, that the text, paper, and binding are of an equally high class order, we have added enough to convince the reader that he will find the volume a distinct addition to the already formidable list of gynecological text-books. H. C. C.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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A Case of Pentosuria.—Ernst Bendix (*Münchener med. Wochenschrift*, September 8, 1903, No. 36) states that although almost a decade has passed since Salkowski first taught that pentosuria is a nutritional anomaly, *sui generis*, very few cases of this condition have hitherto been described. This probably proceeds from the fact that many cases are overlooked on account of lack of symptoms, while others, as a result of insufficient urine examination, are called diabetes mellitus. In preparing his monograph upon this subject Bendix found only about one dozen cases in the literature: three cases by Salkowski and Jastrowitz and Salkowski and Blumenthal, two cases from Bial, one from F. Meyer, two from Brat, one from F. Blumenthal, and three cases from the Italian literature by Luzzato Reale and Colombini, the two last-mentioned cases being doubtful. In addition, three cases of Caporalis are probably not true pentosuria, but cases of glycuronic acid, leaving in all twelve cases in the whole literature. The case reported was from the practice of Dr. Auerbach, in Cologne. The patient was a merchant, aged fifty-two years. Family history good. Neither disturbances of nutrition nor nervous disease among his relatives. His parents died at about the age of eighty years. He himself, from his eighteenth or nineteenth year, suffered with his stomach. Otherwise had never been very strong. Alcoholic and venereal history were negative. About one and a half years ago he suffered severely from influenza, with subsequent stomatitis. Convalescence was very tedious, and the patient lost much weight. At this time it was first ascertained that there was albumin in the urine and that Fehling's solution was also reduced. Since the fermentation test was negative and the urine optically inactive, the reduction of

Fehling's solution was not attributed to the presence of grape-sugar. Bendix was fortunate enough at this time to find that the reducing substance was pentose. The patient was living on a mixed diet. His general nutrition was excellent. The organs of the chest were essentially normal. There was no polyphagia nor polyuria. The patient had never used alkaloids, such as morphine and cocaine. The urine had been repeatedly examined by Bendix and always showed an acid reaction, the specific gravity varying from 1016 to 1028. The albumin test was always positive, the amount varying from ½ to 1½ grams *pro mille*.

Microscopically the cellular elements were scarce; a few leukocytes and epithelial cells were present; casts had never been found. In many of the specimens were uric acid crystals, often calcium oxalate crystals; acetone and acetoacetic acid test negative. Test for indican and diazo negative. Trommer and Fehling tests were positive and perfectly typical in the manner which Salkowski first described for pentose urine. The color change and the separation of oxydul did not occur immediately upon boiling, but only after cooling, and then very suddenly throughout the whole column of fluid. Fermentation was negative. The plane of polarized light was not turned. The phloroglucin reaction and the orcin reaction (the latter also with Bial's modification) were strongly positive. The golden yellow osazone, according to Salkowski's directions, gave the characteristic peculiarities for pentosazone (melting point,155; solubility in hot water and nitrogen content of about 17 per cent.). The amount of pentose in the urine varied from 0.4 per cent. to 0.6. per cent. In this case, then, it is certainly demonstrated that there was an optically inactive pentose in the urine. Probably by analogy with Neuberg's findings it may be an arabinose.

The Influence of the Concentration of the Urine upon the Outcome of the Reactions for Albumin.—Dr. Benno Hallauer (*Münchener med. Wochenschrift*, September 8, 1903, No. 36, p. 1539) found that if normal human urine of ordinary concentration is evaporated on the water bath or *in vacuo* to one-half of its volume and then has added to it 4 per cent. of a serum containing 32 per cent. of albumin, that albumin tests performed upon this urine differ in their results from those given by ordinary albuminous urine. The boiling test gave a stronger reaction than in the case of non-concentrated urine. The Heller's reaction and the acetic-acid-potassium-ferrocyanide reaction are negative, however, with the concentrated urine. But in these cases a precipitation occurs as soon as the urine is diluted with water. The boiling test also fails with the concentrated urine if nitric acid is first added to the specimen. In this case, also, addition of water completes the reaction. He found that if the urine is still further concentrated to about one-quarter of its volume or less, even the boiling test fails to show albumin; but the addition of water restores the normal reactions. The author has tried these experiments with a great number of specimens, using serum from the horse and ox, urine from cases of nephritis, and crystallized serum albumin. The results were always essentially the same. The potassium-ferrocyanide-acetic-acid test, which has hitherto been considered a most delicate clinical test, is the first to disappear. The Heller's test often requires slightly greater concentration.

As to the cause of these phenomena, it appears that urea blocks the

Heller test, while boiling reaction is stopped by urea and neutral salts and the ferrocyanide reaction by certain salts, especially the phosphates.

Concerning the Diagnosis of Chronic Nephritis.—SCHWARZKOPF (*Münchener med. Wochenschrift*, September, 1903, No. 35, 50th Jahrg., pp. 1493, 1494) states that Nothnagel was the first to call attention to the occurrence of casts in the urine without simultaneous albuminuria. Nothnagel observed this in patients with icterus. Since attention has been turned to this subject a number of cases of "cylindruria" have been reported. Most of these were cases of drug-poisoning rather than of nephritis proper, there being a transitory injury to the kidney. The best known cases are those of Lüthje (*Arch. f. klin. Med.*, vol. lxxiv., S. 163), who found in all of his cases, after administering salicylic acid, casts, for the most part, not accompanied with albumin. Trük's dissertation (Tübingen, 1902) gives a résumé of the literature. Schwarzkopf reports five cases considered to be chronic nephritis, in which casts occurred without albumin either for part of the time or for the whole time the patient was under observation. The author agrees with Stewart (THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, 1893) in dwelling upon the importance of remembering this in making a diagnosis in the early stage of chronic nephritis, especially in those cases which are free from cardiac and vascular signs.

Concerning the Absence of Casts from the Urine of Patients with Nephritis.—ADOLF TREUTLEIN (*Münchener med. Wochenschrift*, September, 1903, 50th Jahrg., No. 35, pp. 1494–1496) concludes from his work that casts may be absent from a certain number of cases which otherwise are typical cases of nephritis. He concludes that in these cases the casts are destroyed by lysis resulting from the action of the bacillus coli, the bacillus coli in such cases being an inhabitant of the bladder or of the pelvis of the kidney.

Is Sugar Destruction Completely Stopped after Extirpation of the Pancreas?—LUTHJE (*Münchener med. Wochenschrift*, September, 1903, 50th Jahrg., No. 36, pp. 1537–1539) points out the experimental difficulty of removing all trace of the pancreas. He calls attention to the difference between sugar formation and sugar destruction. The pancreas certainly is concerned in the latter process. There is no ground to believe that the pancreas is the only organ concerned in sugar formation. Minkowski and others have noted that if a dog has its pancreas removed and is kept in a fasting condition the sugar disappears from the urine sooner or later. Lüthje considers this strong evidence that the sugar formed in the body by other organs is being converted. The author reports an extensive experiment in which the duodenum and pancreas were removed, gastroenterostomy between the posterior wall of the stomach and a loop of intestine was performed, and the gall-bladder was tied off. The experimental animal (a dog) was starved from the fifth day before operation. On the sixth day of hunger, that is, the first after operation, the percentage of sugar in the urine was 1.35, with a total of 13.5 grams of sugar. On the second day after operation, 2.25 per cent., a total of 9 grams of sugar. On the third day, 1.8 per cent., a total of 18 grams. On the fourth day after

operation, 0.4 per cent., a total of 4 grams of sugar, after which from the fifth to the tenth day sugar disappeared. The specimen of blood drawn from the femoral vein on the seventh day after operation gave strong reaction with Trommer's test and showed quantitatively 0.312 per cent. of sugar in the blood. The dog died on the tenth day. At autopsy there was a small abscess in the region of the union between the stomach and gut. Lüthje concludes from this that it is definitely proven that even complete extirpation of the pancreas in a dog does not entirely destroy the dog's ability to consume sugar. He discusses the possible factors in sugar metabolism other than the pancreas. (1) The possibility of one or more organs partially taking the place of the pancreas and (2) the possibility that sugar formed in the body after pancreas extirpation has a different chemical origin. He notes the striking fact that the sugar first disappears from the urine of dogs after removal of the pancreas when the dogs have established a constant starvation nitrogen value. It is to be supposed that at this time the animals are beginning to consume their own "organized" albumin and that the "reserve" albumin has been used up. Possibly sugar thus arising from albumin of cells has a different mode of breaking down. This possible hypothesis throws light on the varying amounts of sugar shown by extirpated dogs of differing degrees of nutrition and by well-nourished and cachectic human beings. It explains the fact noted in one of his experiments that after sugar had disappeared from the urine of an operated dog a small feeding of nutrose at once brought about a return of glycosuria.

Leukæmia and Tuberculosis.—SUSSMANN (*The Practitioner*, October, 1903, p. 536) finds that there are only 25 undoubted cases of tuberculosis complicating leukæmia in the literature. He is inclined to the view that it is a rare complication of either the splenomedullary or the lymphatic form. He finds that, whereas tuberculosis is found to be present in from 11 per cent. to 12 per cent. of the necropsies in a series of over 7000, it occurs in only 2.4 per cent. of the autopsies in leukæmia. When the combination does occur, it is two and one-half times more frequent in the lymphatic than in the splenomedullary form. It is six times as common in the male as in the female. The tuberculosis may be found latent and obsolete or it may supervene as a terminal infection. It may be latent and be lighted up as a result of the leukæmic infection. This is the condition most commonly found. When the two diseases occur together the leukocytes are liable to diminish in number and the spleen and glands tend to decrease in size. The writer thinks that this antagonism is possibly due to the excess of nucleo-albumin and the increased phagocytic power of the blood, both of which conditions, he claims, are present in the leukæmic patient.

Arterial Thrombosis of Gonorrhœal Origin.—NORMAN MOORE (*Lancet*, December 16, 1903, p. 1714) reports a case of arterial thrombosis due to the gonococcus, and held to be the first case of the kind reported. A young man, aged twenty years, was admitted to the Manchester Royal Infirmary with gonorrhœa and with early dry gangrene of the left leg. Four days previous to admission he became chilly and feverish. The day before entrance he complained of coldness and pain in the left leg. On admission the left leg was cold, waxy, pulseless, and anæsthetic

below the tubercle of the tibia. The three outer toes showed mummification, and there was discoloration about the ankle. The left common iliac was found not to pulsate. The patient died four days after admission. The evening before death he complained of pain in the right leg, and the pulsation in the right femoral was inappreciable. The limb below the knee was cold, pulseless, and anæsthetic.

The autopsy revealed a thrombus occluding the aorta from the renal arteries to its bifurcation. Both common iliacs and the external and internal iliacs were also filled by the thrombus. The rest of the arterial system was normal. There were no vegetations on the cardiac valves, nor were there any thrombi in the cavities of the heart. Histological examination of the thrombosed arteries showed that there was a definite acute endarteritis. Gonococci were demonstrated by Gram's method in the thrombus. No blood cultures, however, were made before or after death. Moore, nevertheless, concludes that the patient had a gonorrhœal septicæmia; that an acute endarteritis was consequently set up, and that this inflammatory process caused the local development of the thrombus.

SURGERY.

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The Operation of Gastroenterostomy, with Indications for its Performance.—MAYO ROBSON (*Archives international de chirurgie*, 1903, vol. i., No. 1) states that the operation of gastroenterostomy is imperative in the following conditions as soon as the diagnosis is established: 1. In cases of pyloric stenosis leading to dilatation of the stomach; here gastroenterostomy provides a new outlet for the passage of the stomach contents, and thus saves the patient from starvation and death. The advantage of this operation over pyloroplasty is that in the latter operation contraction of the new orifice occasionally occurs, and this is especially apt to take place if there be active ulceration going on at the time of the operation. 2. In malignant stenosis of the pylorus; the operation has been followed by brilliant results in this class of cases and the author's experience has shown the immediate results to be almost equal to those of simple stenosis. 3. A degree of congenital stenosis is doubtless a frequent though often an unrecognized cause of dilatation of the stomach in young adults. A number of such cases have been reported and gastroenterostomy has been followed by brilliant results. 4. Congenital atresia of the pylorus, in which no passage exists between the stomach and intestine, is a defect which in all recorded cases has run a rapidly fatal course. If diagnosed early it should be treated by gastroenterostomy. 5. In chronic ulcer, with tumor of

doubtful character, too extensive or adherent for effectual removal, this operation has in some cases, where merely temporary relief only was anticipated, been followed by a complete and permanent cure. 6. In cancer or tumor of the duodenum producing obstruction to the onward passage of the stomach contents, gastroenterostomy acts in exactly the same manner as in cancer of the pylorus. As a rule, this form of disease in the second part of the duodenum is removable only with the greatest difficulty, in consequence of the important structures in the border of the lesser omentum being involved. 7. Hour-glass contraction of the stomach may be due to chronic ulcer or to cancer. If the contraction be due to simple ulceration, gastroplasty is the operation of choice, and in a number of cases the results have been excellent; but if the stricture be a long one and the thickening be very extensive, then gastroenterostomy, in which the proximal cavity is united to the jejunum, is the better operation; but great care must be observed that the junction is not made between the bowel and the distal cavity, otherwise no benefit will ensue. It should be the operation of choice when pyloric stenosis is associated with hour-glass contraction. 8. In perigastritis with adhesions the operation of gastroenterostomy may be entirely curative; at least, it has been so in many cases; but there are some cases where the adhesions are so extensive and the secondary dilatation of the stomach is so well marked that to rest content with simply detaching adhesions would be to court failure. If the pylorus is patent, yet embarrassed by adhesions, one should always separate them, and try to avoid their recurrence by interposing the right free border of the omentum between the raw surfaces left by the gastrolysis, thus substituting a long, freely movable attachment for short binding ligaments should adhesions re-form. If, however, adhesions are very extensive and very short, dense, and firm, the operation of posterior gastroenterostomy had better be done, and this especially if at the same time there is stenosis of the pylorus or hour-glass stomach. 9. In tumor outside the pylorus, but pressing on it and causing obstruction to the passage onward of the stomach contents, gastroenterostomy may be required at the same time that the tumor is treated. The following indications apply only after the failure of systematic medical treatment: 10. In ulcer of the stomach, whether acute or chronic, not yielding to medical treatment, surgical treatment is in the greater number of cases the only satisfactory method of dealing with these refractory cases, and operation should be resorted to at a much earlier period than has hitherto been the custom, and always before the patient is so far reduced by pain and starvation or the supervention of serious complications that weakness and anæmia render any operative procedure hazardous. Before the abdomen is opened it is quite impossible to say what operation or operations will be required, and the surgeon must be prepared to adapt himself to circumstances on discovering the position of the ulcer and the conditions associated with it, especially as to the presence or absence of adhesions and other complications. Gastroenterostomy acts by securing physiological rest of the stomach and, at the same time, curing the hyperchlorhydria which is usually present. 11. Duodenal ulcer very frequently fails to yield to general treatment, and the author believes it is much more frequently the cause of fatal symptoms than is generally recognized. 12. In hemorrhage from the stomach or duodenum, as shown by hæmatemesis or melæna,

where general treatment has been tried or failed and where the bleeding is persisting or recurring after brief intervals, operation is advisable, with a view to find and to secure, if possible, the bleeding point or points, or of performing gastroenterostomy in order to obtain physiological rest and thus to favor natural hæmostasis. 13. In persistent spasm of the pylorus, or Reichmann's disease, leading to dilatation of the stomach, pylorodiosis or stretching the sphincter may be effectual in relieving spasm and in producing immediate relief to the obstruction, but as it is apt to be followed by relapse, gastroenterostomy would seem to be the better operation. 14. Hyperchlorhydria is a concomitant of ulcer of the stomach, though it may occur apart from ulceration. As a rule, it yields to medical and general treatment, but where this fails to relieve and the life of the patient is being made miserable by constant indigestion with acid eructation, the operation of gastroenterostomy is well worth consideration, especially when in such a case it can be performed with almost no risk, for in the absence of complications such as occur in ulcer or cancer, the operations, when properly performed by an expert, ought to have no mortality. 15. Persistent gastralgia: Cases must have occurred in the practice of every physician where, although the positive signs of ulcer were absent, gastralgia of such intensity had persisted and in case of temporary relief had recurred so regularly that the patient is brought to the last stage of exhaustion by an utter inability to take food because of the pain induced by even a mouthful of solid food. Some of these cases are doubtless due to simple ulcer, but in others the absence of tenderness in the epigastrium, of rigidity of the recti, of regular vomiting, and of hæmatemesis, makes the diagnosis extremely doubtful. Even rectal feeding and absolute rest in bed do not always cure the condition, and the patient gradually loses weight and strength and lapses into a state of chronic invalidism without any positive sign of organic disease. After all ordinary means have failed, gastroenterostomy is well worthy of consideration, and in one case in the author's experience it led to an excellent result. 16. In tetany of gastric origin. The prognosis of tetany occurring in gastric dilatation is undoubtedly very serious, and, according to some authorities, death occurs in 75 per cent. of the cases. The largest mortality occurs in cases where the cramps in the extremities are associated with tonic spasms in the head and trunk muscles or with clonic spasm. The author's experience would tend to show that the early surgical treatment of these cases may be followed by most beneficial results. 17. Acute gastric dilatation is one of the most serious diseases that can be encountered. But that the condition is not hopeless has been well shown by one case where lavage was followed by a cure. As yet gastroenterostomy has not been tried as a means of relieving this condition. 18. In an exceptional case of ulcer of the stomach eroding the pancreas and producing pancreatitis, with abscess draining into the stomach, a gastroenterostomy apparently saved the life of the patient by draining the very foul contents directly into the intestine. 19. Cholelithiasis may lead to perigastritis, and the contraction of bands of lymph around the pylorus may produce obstruction or kinking, thus leading to dilatation of the stomach, at the same time that the concretions lead to obstruction of the bile ducts. As a rule, the condition can be relieved by gastrolysis, but where the adhesions are extensive or the thickening of the pylorus is very pronounced, the operation of gastroenterostomy may have to be performed at the

same time as the cholecystotomy. Gallstones may also lead to fistula between the gall-bladder and pylorus and the thickening of the pyloric canal may lead to obstruction, for which gastroenterostomy may be the most suitable operation, though in the cases that have come under the care of the author the repair of the fistula in one case and pyloroplasty in another were sufficient, when combined with cholecystotomy, to remedy the disease. 20. In atonic dilatation of the stomach, general and medical treatment, supplemented, if need be, by electrical treatment and lavage, if carried out systematically and for a sufficient length of time, usually yield good results; but in some cases, despite regular lavage of the dilated organ, well-regulated diet and general medical treatment, the dilatation persists and the nutrition of the patient and the general health become seriously impaired. In such cases the operation of gastrorrhaphy or gastroplication may be worth considering, though in certain cases gastroenterostomy may possibly be performed with advantage. The indication for operation in these cases is not so distinct as in the case of dilatation due to pyloric obstruction, seeing that the cause is a general one; nor is the recovery after operation so rapid and satisfactory. The general health requires considerable attention at the same time that the stomach is being dealt with.

Splenectomy for Banti's Disease.—QUEEN and DUVAL (*Revue de chirurgie*, October 10, 1903) state that the principal characteristics of this affection are: 1. Obscure etiology; neither alcohol, syphilis, nor tuberculosis apparently being a factor. 2. The enlargement of the spleen in all directions is the initial symptom. 3. As a result of this enlargement there develops an anæmia, which is fatally progressive, but whose duration is variable, but always long, varying from three to twelve years. 4. During this anæmia the urine contains urobilin, the skin and the conjunctiva become jaundiced, and a diarrhœa appears and usually lasts for some months. 5. The ascitic phase then appears. The liver is sclerosed and the cirrhosis of Laennec, which makes rapid progress, appears. 6. During the disease there is no leukocytosis, but there is a diminution of hæmoglobin and corpuscles. 7. The morbid pathology consists in an enormous enlargement of the spleen, of from one to two kilograms in weight. Histologically there is an atrophy of the pulp and a sclerosis, with hypertrophy of the capsule and the reticulum and a partial sclerosis of the Malpighian corpuscles. The liver is small, hard, granular, with a cirrhosis, presenting all the characteristics of Laennec's atrophy. 8. The bacteriological examination of the blood and the spleen is always negative. 9. The extirpation of the spleen is followed by a radical cure of the disease. If there exists a beginning hepatic cirrhosis, the splenectomy arrests its development. The authors report one case in their own experience and six others collected from the literature in which splenectomy was followed by a complete recovery.

Adrenalin in Local Anæsthesia.—BRAUN (*Centralblatt für Chirurgie*, 1903, No. 38) states that the two most important points to be considered in the use of adrenalin for this purpose are the dose and the danger of secondary hemorrhage. As regards the dose, such a very powerful drug as it is should only be used with great care. A dose of 1 milligram is entirely too big to be subcutaneously injected. In one case an injec-

tion of 20 c.c. of a 0.5 per cent. solution of eucaine "B." with 10 drops of the 1:1000 adrenalin solution, caused vomiting and prostration, which lasted for an hour; in several other cases this dose caused some cardiac palpitation. Hartwig and others have had some very unfavorable symptoms from this dose, and Enderlen has reported a case where the injection of 8 cg. of cocaine, with 8 drops of adrenalin solution, was followed by a fatal result. The best solution would seem to be one composed of hydrochloric acid, 0.2; sodium chloride, 0.8; and distilled water, 100 parts. Then 10 c.c. of this mixture should be placed in a test-tube and heated to the boiling point, and then 1 cg. of adrenalin added, and the solution again boiled. This will give a colorless solution, in which the greater part of the salt is neutralized by the adrenalin. 2 drops of carbolic acid should be added and then the fluid should be kept in bottles holding from 3 c.c. to 5 c.c.; this solution will keep indefinitely. As regards hemorrhage, it is apparent that the anæmia resulting from the use of adrenalin is not followed by hyperæmia nor tissue paralysis, and it is not possible to secure accurate hæmostasis in the presence of adrenalin. So care should be taken to use a very small dose of adrenalin; this markedly intensifies the duration and degree of the anæsthesia, but will not contract the arteries so as to interfere with the proper control of any bleeding that may occur.

Retroduodenal Choledochotomy.—QUERVAIN (*Centralblatt für Chirurgie*, 1903, No. 40), after mentioning the work of Berg, Lane, Kocher, etc., states that though this operation is but rarely performed, still it may not be considered as a new method. After noting in detail a case operated upon by this method with a perfect recovery, the author states that, as regards technique, the incision of the duodenum must be done very carefully and most accurate hæmostasis secured, and so any drainage to the intestinal wall will be avoided, as well as serious hemorrhage. Should the duodenum be turned over inward, then one should incise the choledochus at the point where it is not covered by the pancreas. The best indication of the point to cut is usually the easily felt stones. As to the choice between the retroduodenal and transduodenal methods, the former method is to be recommended in all cases where the duodenum may be easily removed. If, however, it and the pancreas are closely matted together with adhesions and further progress by the retroduodenal route is distinctly dangerous, then one should abandon all attempts at further separation and at once proceed with the transduodenal operation.

Ogston's Operation for Clubfoot.—LAUENSTEIN (*Centralblatt für Chirurgie*, 1903, No. 39), after considering the question in detail, reaches the following conclusions: 1. Experience has shown that this operation is not a difficult one. 2. A careful examination with *x*-rays should be made in every case, and whenever possible a radiograph should be taken. 3. The amount of bone removed must be gauged by the circumstances present in each individual case. 4. When sufficient bone has been removed, then the abnormal position can be easily and thoroughly corrected, and retention in good position can be easily obtained. 5. The after-treatment is shorter; at the end of eight weeks the child may safely be allowed to walk with a properly fitting shoe. 6. Radiographs taken subsequent to the operation show that there is

absolutely no danger of any failure of development of the foot. 7. To just what age this operation should be limited has as yet not been determined.

A New Modification of Maydl's Operation for Congenital Ectopy of the Bladder.—BORELIUS (*Centralblatt für Chirurgie*, 1903, No. 29), after noting in detail two cases in which he used the modified method, states that the essential points in the technique are: 1. A careful separation of the bladder and the forming of an elliptical piece, which includes the ureters. 2. The opening of the abdominal cavity so that the sigmoid flexure may be pulled well forward. 3. A lateral anastomosis between the upper and lower portions of the sigmoid. 4. A longitudinal incision at the top of the flexure and the implantation of the ureters. 5. The wound should then be closed with sutures.

Wound of the Epigastric Vessels as the Result of Puncture for Ascites.—BAUM (*Deutsche Zeitschrift für Chirurgie*, August, 1903) reports the case of a man, aged fifty-five years, who presented himself for treatment with cirrhosis of the liver with marked ascites. Puncture being decided upon, it was done in the usual manner in the median line and a large quantity of fluid withdrawn. As the fluid rapidly accumulated, another puncture was made 1 cm. to the left of the linea alba and 8.5 cm. above the symphysis, and then 4300 c.c. of fluid was withdrawn. The patient was not uncomfortable until three hours later, when he complained of much pain in the abdomen and a sense of distention as from tympanites. Examination showed the abdomen markedly distended, more especially so on the left side, more or less rigidity, an increase of pain on pressure, and dulness on percussion over the distended area. The skin was apparently unaltered, and fluctuation could not be elicited. A diagnosis of laceration of the epigastric artery having been made, the abdomen was opened at once under local anæsthesia at the point where the puncture was made. The fatty tissue was found to be infiltrated with blood, and as soon as the peritoneum was opened there was a rush of blood from the wound. Many blood clots were found and these were removed after the torn epigastric vessels had been ligated. The wound was drained at each end and then the intervening portion closed with sutures. The further course was in every way normal, the patient making an uninterrupted recovery. In view of this case, it would seem important to remember that when this accident does occur an immediate laparotomy is indicated, and that it is much less likely to occur if the puncture be made in the median line.

Adenoma of the Umbilicus.—KOSLOWSKI (*Deutsche Zeitschrift für Chirurgie*, August, 1903) states that in the embryo the middle intestine is a straight tube, which communicates with the yolk sac. About the fourth week the intestine is twisted toward the umbilicus and becomes joined with it, and about the eighth week the ductus omphaloentericus becomes obliterated into a thin cord, which is still present at the third month. Seldom is this obliteration of the ductus omphalomesentericus complete; it retains its connection with the intestine and causes an inversion of the intestinal canal (Meckel's diverticulum), which is connected to the umbilicus by this obliterated cord. This may give rise to various pathological conditions; among the most interesting is the fol-

lowing case of fibroid adenoma. The patient states that five weeks ago he noticed in the median line, between the symphysis and the umbilicus, a small and somewhat painful swelling, which had increased in size until it was about as large as a walnut. The area of pain seemed to be enlarging and involved all the abdomen. The patient, though fifty-five years of age, looked to be over seventy years, with marked arteriosclerosis, emphysema, and an unusually poor general appearance. On examination there is a small tumor in the median line, about midway between the symphysis and the umbilicus, very painful on pressure; the skin over it is freely movable, but the tumor itself is hard and more or less adherent to the surrounding structures. Toward the umbilicus a cord can be made out. The abdominal walls are rather thin and the urogenital and intestinal tracts present nothing abnormal. The median position of this tumor with the presence of this cord induced the diagnosis of epithelioma and an operation for its relief was performed. An incision in the median line was made over the tumor; this incision was continued on either side of the tumor until the peritoneal cavity was opened. The tumor was then pushed upward and it was found to be a fibroma of the ductus omphalomesentericus. Extirpation of the tumor and the cord was then done and the wound closed. The patient made an uninterrupted recovery. Wyssokowitsch, who made the pathological examination, reports that the tumor is a submalignant fibroadenoma. It is of interest to note that but four other analogous cases have been reported.

THERAPEUTICS.

UNDER THE CHARGE OF

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Colloidal Silver.—Dr. H. S. Loebl has treated various forms of sepsis, erysipelas, and puerperal processes by intravenous injections of this substance. When the intravenous method is impossible he makes use of rectal injections, 1:500 or even 250 parts of distilled water, the amount of menstruum employed being 3½ ounces, twice daily. The injection is preceded by a cleansing enema. The advantages of this method are obvious, while the results are usually satisfactory.—*Wiener klinische Wochenschrift*, 1903, No. 44, p. 1230.

The Abortive Treatment of Gonorrhœa.—Dr. Ferdinand Fuchs recommends the use of albargin in this connection. This preparation contains 23.6 per cent. of silver nitrate, while protargol contains only 8.3 per cent., and is easily soluble in water. The treatment must be instituted not longer than seventy-two hours after the suspected coitus,

and is still more successful if forty-eight hours or less have intervened. Thus early in the infection microscopic examination of the urethral secretion shows squamous epithelial cells, leukocytes, and a few gonococci, sometimes free, sometimes in the epithelial cells, but seldom within the leukocytes. The technique of the treatment is as follows: A 2 per cent. albargin solution is injected by means of an olive-tipped hand syringe into the anterior urethra until the patient complains of a sensation of distention. This injection is retained for five minutes and is then allowed to escape. A second injection is now given and the solution retained for three minutes. This is followed by a third, which is retained for two minutes. It is seldom that pain is complained of, but on the following night the patient may be troubled with frequency of urination. After the injection examination shows fewer leukocytes and no gonococci, and in about fourteen days the secretion entirely disappears. No complications have followed in six cases reported by the author, and in all of them equally good results have been attained. —*Therapeutische Monatshefte*, 1903, No. 10, p. 508.

Hedonal.—Dr. Johann Fraczkiewicz reports that this new hypnotic, the chemical formula of which is $CONH_2OCHCH_3C_4H_7$, which physically is a white crystalline powder easily soluble in alcohol, ether, and boiling water, and less so in tepid water. Its taste resembles that of menthol. He uses the drug in doses of 20 grains for women and 30 grains for men. In these doses it produces in from fifteen minutes to one hour a moderately deep dreamless sleep, lasting from five to eight hours, and not followed by unpleasant after-effects, such as headache, dizziness, or ringing in the ears. During the slumber the heart action and respiration are not affected. In persons with normal kidneys the drug has a slight diuretic action, but is not so active in this regard as to disturb the rest of the patient. When there is kidney disease the diuretic effect seems to be *nil*. In cardiac disease the drug seems to do no harm. In conclusion, the author asserts that hedonal appears to be useful in the insomnia of hysteria, neurasthenia, marasmus senilis, and in psychoses of the milder grades. In these conditions it does no harm, even when continued for a considerable period; its diuretic effect is not cumulative. In insomnia due to pain it is useless.—*Therapeutische Monatshefte*, 1903, No. 11, p. 572.

Phosphorus in Psychasthenia.—Dr. Alfred Martinet asserts, as a result of his clinical observations upon phosphoric medication in psychasthenia, that in the accidental forms of the condition when taken early the treatment is quickly followed by a return of the mental processes to a normal state. In habitual psychasthenia of long standing the treatment when continued for considerable periods of time results in a progressive amelioration of the condition. In psychataxia with agitation the phosphoric medication produces a rapid aggravation of the pathological state. The phosphorus is prescribed as follows: Official phosphoric acid, 10; acid sodium phosphate, 20; distilled water, 200. Of this the patient takes at first 30 drops in a glass of water with each meal, progressively increasing the number of drops taken to 100. If there are dyspeptic or other symptoms, these are treated at the same time according to ordinary methods.—*La presse médicale*, 1903, No. 93, p. 805.

Lecithin —Dr. Henri Labbe believes that this drug fulfils all the indications of phosphorus and the glycerophosphates. In rickets with cod-liver oil (lecithin,1; cod-liver oil, 250) it seems to cause a cessation of the disease in from four to six months. In cases of defective growth it has also given favorable results. It is indicated in dyspepsia with phosphaturia, unless this latter is due to overfeeding, in which case, however, it may be given in small doses ($\frac{3}{4}$ to $1\frac{1}{2}$ grains) in connection with a properly regulated diet. In neurasthenia and anæmia it relieves the symptoms, increases the patient's strength and the hæmoglobin and the number of red blood cells. In tuberculosis and senile debility it betters the general condition, but in the former disease the lesions do not seem to be modified. In diabetes, especially of the pancreatic variety, it increases the strength and weight, but does not alter the amount of sugar in the urine. In cachectic and convalescent states, except those following malaria, it is a valuable aid in the regeneration of the blood. In certain cases it acts as a heart stimulant when digitalis is useless. The continued administration of the drug is entirely harmless.—*Revue de thérapeutique*, 1903, No. 21, p. 721.

The Treatment of the Cardiac Complications of Rheumatism.—Dr. F. Combemale believes that if murmurs appear the cardiac condition should be closely watched for at least four weeks, during which period treatment by means of sodium salicylate should be continued; the patient should remain absolutely at rest in bed, and all excitement must be avoided. When acceleration of the pulse is noted sparteina in the following formula is prescribed: sparteina sulphate, 1; syrup of tulu, 10,000; distilled water of linden, 20,000. Of this two tablespoonfuls are given daily. Precordial pain calls for counterirritation by means of cupping or vesicants, which measures should be continued if the pain persists. If the pulse becomes irregular, as well as rapid, digitalis in the following formula: powdered digitalis leaves, 50; water, 120; fluid extract of convallaria, 30. The daily dose of this mixture is 7 to 8 drachms. Caffeine should not be employed unless myocarditis is present. —*Annales de la Polyclinique de Paris*, 1903, No. 11, p. 261.

Arsenous Acid in Cancerous Ulcerations —Dr. Roux de Brignolles is inclined to the theory that the topical application of arsenous acid exerts a specific action in certain forms of epitheliomatous ulcerations. In two types of cancerous lesion he has found its use followed by most happy results. These are ulcerations recurrent in the cicatrix after operation for carcinoma of the breast and cutaneous epitheliomata. Such lesions taken early and before gland involvement may be readily cured. He believes that the curative effect of the arsenic is due to a dehydration of the cancerous tissue in the presence of fresh blood and alcohol and the combination of the drug with the cancerous elements to form an albuminate and to lessen the degeneration of the connective tissue. He uses the arsenous acid in the following formula: powdered arsenous acid, 1; ethyl alcohol and distilled water, of each, 50. With this mixture the cancerous surface is painted after having been cleansed, during which process a few drops of blood, not more, must have been caused to flow. The application is allowed to evaporate and no dressing need be applied. On the next day the surface which has been treated will be covered by an eschar, which is not removed, but upon which

daily applications like the first are made until the crust becomes completely black and easily movable upon the tissues beneath. The crust may now be removed and another application made; if on the next day the resulting crust is easily movable one may be sure that the treatment is successful. If the crust is firmly fixed the treatment must be continued as before until the entire disappearance of the cancerous elements.—*Gazette médicale de Paris*, 1903, No. 47, p. 389.

Empyroform.—Dr. Alfred Kraus reports upon this new tar preparation, which is a condensation product of birch tar and formalin. It is used as a 1 per cent. solution with chloroform and acetone, as a paint with chloroform and traumaticin, or as a 5 per cent. ointment with equal parts of lanolin and vaselin. It is most useful in chronic eczema, relieving the itching in a decided manner, and it is even useful if there be acute symptoms. In psoriasis, lichen urticatus, prurigo, pityriasis rosea and versicolor it has given good results.—*Prager medicinische Wochenschrift*, 1903, No. 33, p. 419.

The Action and Therapeutic Application of Radium.—Dr. Jumon reports encouraging results from the therapeutic use of this substance in lupus. After the radium rays have been applied for five or six days the surfaces to which they have had access become reddened, and after prolonged application an appearance like that of a second-degree burn or an ulceration of the surface may be produced. The ulcers are whitish or yellowish, shallow, not indurated, painless, and slow to heal. This latter process may be facilitated by the use of dressings wet with boric acid solution. If pus germs gain access to the abraded surface suppuration may ensue. When the healing is complete, white, soft, superficial cicatrices usually result. If the application of the rays has been too short the ulceration produced is too superficial, and recurrence of the original lesion is likely to take place. On the other hand, permanent cure follows the application of "plaques" of radium of an intensity of from 5000 to 19,000 for from twenty-four to thirty-six hours. Such a treatment results in a white, pearly cicatrix, sometimes surrounded by a zone of brown pigmentation. The scar is flexible, not indurated, and unlike that produced by ordinary measures. So far as immediate result is concerned, the curative effects seem excellent; what the ultimate result will prove to be only time will tell. The advantages of the treatment are its simplicity, its freedom from pain, and the comparatively short time needed for its completion. Undoubtedly study of the subject will be followed by modifications of the technique of the use of the substance.—*Revue de thérapeutique*, 1903, No. 20, p. 692.

Ascites Treated by a Diet Free from Chlorides.—M. Achard reports two cases of ascites, one due to hepatic cirrhosis, the other to mitral insufficiency, where a diet in which the chlorides were reduced was followed by good results after a milk diet had failed to benefit the patients. The diet prescribed was as follows: sixteen ounces each of meat and potatoes, two ounces of rice, five ounces of sugar, and forty-five grains of salt. The first patient's weight fell in twenty-five days from 138 to 119 pounds, and so remained after an ordinary diet had been resumed; the diet prescribed was but slightly poorer in salt than the milk diet, but the diuresis due to the sugar and starches aided the

organism in the excretion of the chlorides. The ascites of the second patient increased under ordinary diet; but being put upon a diet lacking in salt her weight remained stationary for twelve days, after which the daily ingestion of 5 drachms of salt resulted in an increase of the ascites and an increase of eight pounds in weight in six days. Examination of the ascitic fluid showed a diminution in its chlorides when the patient was upon the diet lacking in salt and a rapid increase in these elements when ordinary regimen was resumed.—*La semaine médicale*, 1903, No. 45, p. 369.

PEDIATRICS.

UNDER THE CHARGE OF

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Infections of the Newborn.—S. McC. Hamill and W. R. Nicholson (*Archives of Pediatrics*, September, 1903, p. 641) report a series of cases of infections of the newborn, and present the conclusions from their study. They do not incline to accept as pathological entities such conditions as melæna neonatorum, hemorrhagic disease of the newborn, Buhl's disease, Winckel's disease, etc. According to their observations, and in accordance with the literature, all the clinical symptoms described under these various titles may exist as manifestations of a number of different infections, the nature and severity of the symptoms depending upon the character of the infecting organism. Any classification, therefore, must depend upon a bacteriological basis.

In the six cases recorded six different micro-organisms were isolated, viz., the bacillus pyocyaneus, the bacillus lactis aërogenes, the colon bacillus, the staphylococcus aureus, the bacillus coli immobilis, and a streptococcus. In their complete list of cases, amounting to about fifteen, only one other micro-organism, an unclassified micrococcus, has been encountered. Various other organisms have been found in similar infections, but those most commonly encountered are the streptococcus, the bacillus coli communis, and the staphylococcus. Délestre, for instance, in thirty-seven positive cultures from infected infants, found the streptococcus fourteen times, the colon bacillus ten times, and the staphylococcus six times.

The post-mortem findings may be summed up in the words "congestion" and "hemorrhage," varying in degree in different cases. There is usually a considerable degree of congestion of the spleen, the mesenteric lymph nodes, the kidneys, suprarenals, liver, stomach, or intestines. Ulceration in various portions of the gastrointestinal tract has been recorded. The liver, kidneys, and the suprarenal glands may be the seat of hemorrhages. Hemorrhages into the serous cavities are common.

The bladder may contain bloody urine, and sometimes ecchymosis of its mucous membrane is present.

The principal changes in the thoracic organs are: enlargement and congestion of the mediastinal glands, congestion in the lungs, areas of atelectasis or pneumonia. The heart muscle is sometimes soft and frequently its vessels are enormously distended.

Histological studies are incomplete. The changes are those commonly found in infectious conditions, namely, cloudy swelling, fatty degeneration and infiltration of the liver and kidneys, in addition to the changes resulting from hemorrhage.

Most of these infections occur in maternity hospitals, where the opportunities for the spread of disease germs are great. It is possible that the origin of these infections depends upon the presence of the various micro-organisms which bacteriological investigations have demonstrated in the air and dust of wards.

The mother's milk also has been held accountable, and not only in the presence of suppurative lesions of the breast, but also in milk from apparently normal breasts, have pathogenic organisms been isolated. The use of the same bath for several infants and the bedding together of the infected and the non-infected has resulted in conveying the infection.

Admitting the possibility of these sources of infection, the authors, nevertheless, incline to the belief that the most common medium is the poorly trained or careless nurse. In the institutions in which they have observed these cases they have noted that they were not confined to one ward; that they have been handled by the same nurse, and that the bacteriological studies have shown the presence of different organisms in the different cases. The literature shows few examples of any one organism being held accountable for all the cases in an epidemic. These facts, they think, are against the greater frequency of air infections.

The authors believe that the cord has been given too much prominence as the point of entrance, and that the most common ports of entry are the buccal cavity, the tonsils, and the remainder of the alimentary tract, and next in order the lungs.

As very little can be done in the way of treatment when infection is once established, the necessity for prophylactic measures by improving the general aseptic technique of maternity wards is of great importance.

Absolute cleanliness on the part of the attendants, careful handling of the napkins, bed-pan, etc., separate wards and special nurses for the infants are some of the measures which would prevent, to a certain extent, these infections. The advisability of the routine practice of cleansing the infant's mouth is questioned. The recognition of any pathological condition of the breasts, such as erosions or fissures, should be a signal for the immediate withdrawal of the infant.

The Overlying of Infants —WESTCOTT (*British Medical Journal*, November 7, 1903) gives some statistics upon this too frequent cause of death among infants in England.

During the last decade there were 15,009 overlain infants in England and Wales, and for the year 1902 London alone presented the shameful mortality of 588 deaths from this cause.

The danger diminishes with the age of the infant, until at a year old the risk of suffocation by the mother is trifling.

The dead infants presented the well-known signs of death by suffocation: bluish lips, flexion of the legs and arms, clenched hands, and froth, often blood-stained, in the nostrils and mouth. Many showed undoubted marks of pressure—for example, a flattened nose. The common post-mortem findings in an infant that has died from suffocation are: engorged lungs, sometimes œdematous; congestion of the brain and meninges, the right heart containing soft clot and the left heart empty; the pleura and pericardium showing minute ecchymoses.

Westcott deplores the fact that this habit of mothers taking infants to their own beds is so common in England, and, as it is impossible to punish parents under the existing laws, even when drunkenness is proven, he thinks it should be declared an obligation on every parent to provide a cot or cradle for the infant's use.

GYNECOLOGY.

UNDER THE CHARGE OF

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ASSISTED BY

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Examination of the Blood in Cases of Ovarian Cyst.—Pozzi and Bender (*Annales de Gynécologie et d'Obstétrique*, October, 1903) conclude a paper on this subject with the following deductions: 1. In the majority of the cases the benign or malignant character of an ovarian cystoma may be inferred from examinations of the patient's blood. 2. If the red cells are normal and the white are in the proportion of from 6000 to 8000, the tumor is benign. 3. A moderate leukocytosis with a normal number of red cells may indicate suppuration, though an increase in the white cells is noted in the case of large cysts; no positive inference can be drawn with reference to malignity. 4. With a diminution of the red cells and a leukocytosis from 12,000 to 20,000 malignant degeneration may be suspected.

The presence of anæmia is a more important indication than the increase in the white cells. The percentage of hæmoglobin is of course an important aid. The writers add that blood examinations are of especial value from the standpoint of prognosis, citing two cases in which patients with marked diminution of red cells and leukocytosis succumbed quickly after operation, without infection

Cystitis in the Female.—Vedeler (*Norsk Mag. for Laegerid.; Zentralblatt für Gynäkologie*, 1902, No. 42) found only 380 patients with cystitis among 10,000 gynecological cases. He regards coitus as an etiological factor. Only 1.5 per cent. of the cases occurred in virgins, 2.5 per cent. in widows, but over 5 per cent. in married women. Of the 3 cases in little girls 2 were due to gonorrhœa following attempted coitus. Four cases resulted from the use of catheters, and in 22 cystitis

was referred to syphilis, typhoid, tuberculosis and lithiasis. In only 45 was there no accompanying disease of the urethra and genital organs. Menstruation, the climacteric, and early pregnancy seemed to have no influence upon the condition, though menstruation apparently caused an exacerbation of existing cystitis.

[We are surprised to note that so few cases were traced to the use of the catheter, which, according to our observation, is the commonest cause of post-operative cystitis.—H. C. C.]

Plastic Operation for Hydronephrosis.—PETERSEN (*Münchener med. Wochenschrift*, 1903, No. 11) describes an ingenious operation for the relief of obstruction to the ureter following incision and drainage of a hydronephrotic kidney. The obstruction proved to be a valvular fold of mucous membrane at the entrance of the ureter. This was removed by making a longitudinal incision as in pyloroplasty and closing it transversely with catgut sutures. The renal sac was then folded on itself at several points and the folds were sutured, so as to reduce the size of the pelvis as much as possible. The drainage of urine through the wound rapidly diminished, and at the end of six weeks the patient was discharged cured.

Paraffin Injections in Incontinence of Urine.—HOCK (*Prager med. Wochenschrift*, 1903, No. 6) reports the case of a girl, aged twenty-three years, who six years before had had a calculus removed per urethram, with resulting incontinence which resisted all treatment. After two operations for narrowing the urethra, and one in which torsion was performed, her condition was worse than before. A second torsion gave only slight relief. Two injections of paraffin (75 grains each time) were made at the neck of the bladder, when the incontinence was speedily cured. Three months later the patient again began to have dribbling of urine, and the injections were twice repeated, with permanent relief. The paraffin remained unchanged at the point of injection.

Operations for Uterine Fibroid.—CZEMPIN (*Zentralblatt für Gynäkologie*, 1903, No. 42) reports 140 cases in which the principal indication for operation was obstinate menorrhagia. He prefers the vaginal route, saving the uterus if possible. Of the 58 vaginal operations hysterectomy was performed 17 times with no deaths. In 82 of the abdominal operations supravaginal amputation was performed 19 times with 4 deaths, and hysterectomy 44 times with 6 deaths. Two deaths were due to embolus, 5 to shock, and 3 to sepsis. There was no mortality in 19 conservative abdominal operations.

Myoperithelioma.—GOTTSCHALK (*Zentralblatt für Gynäkologie*, 1903, No. 42) reports the following case, which he regards as unique: The patient, aged fifty-one years, had multiple uterine nodules, which grew rapidly and were accompanied by a constant bloody discharge. The diagnosis of fibroids with malignant degeneration was made, and the uterus was removed successfully. Numerous fibroid nodules were found, especially sessile submucous. The latter were covered with papillary excrescences, as well as the surrounding endometrium.

Microscopic examination showed that the growths had developed from the perithelia of the adventitia and from the deeper, rather than

from the superficial vessels. In the sections of the myomata the ordinary alveolar structure of cancer was found, while in the superficial portion the pure perithelial type prevailed. The conclusion drawn by the writer was that the malignant change began in those vessels of the myoma just beneath the mucosa.

Retroflexion.—KOVWER (*Zentralblatt für Gynäkologie*, 1903, No. 42) found 239 cases of retroflexion in 2800 gynecological cases (8.5 per cent.), of which 210 were treated. In 135 the uterus was movable, and in 75 adherent. Of the latter only 7 were operated upon, the remainder being treated with tampons. Thirty-one patients were subsequently able to wear pessaries; 25 per cent. were cured. One hundred and twenty cases of movable retrodisplacement were treated with pessaries; in 6 no treatment was necessary, and of 9 patients operated upon, 10 per cent. were cured. Only 16 out of the 239 patients (6 per cent.) were operated upon. Alexander's operation was preferred in movable retroflexion, 9 operations being recorded with 6 cures.

The writer notes that in the 5 abdominal operations for adherent retrodisplacement not a single patient was permanently relieved. He is entirely opposed to the surgical treatment of retroflexion, since by no method can the uterus be restored to its normal position. This is possible in some cases by the use of pessaries. Young girls should be treated as little as possible.

[The frank pessimism of this writer is in striking contrast with the enthusiastic reports of most surgeons. In fact his skepticism is so avowed as to awaken the suspicion that he is an extremist. Between the views of those who denounce the use of pessaries and the opinions above expressed there is certainly a middle course which is safer than either extreme.—H. C. C.]

Treatment of Inoperable Cancer of the Uterus.—BLAU (*Zentralblatt für Gynäkologie*, 1903, No. 45) reports the result of palliative treatment in 408 cases of inoperable cancer in Chrobak's clinic. The routine method consisted in removing as much of the diseased tissue as possible with the sharp spoon and cauterizing the new surface with fuming nitric acid or the Paquelin. The cavity is then tamponed with iodoform gauze, which is removed in four days. To promote granulation and cicatrization applications of tincture of iodine are made every two or three days. At intervals of three or four months the surface is touched with nitric acid or a 20 per cent. alcoholic solution of bromine. Iodoform is used freely for foul discharges, with injections of permanganate of potash or creolin. Only two patients succumbed to the operation.

342 patients were kept under observation. In three cases which presented all the clinical appearances of cancer of the cervix (though the specimens were not examined microscopically) one patient lived for eleven years before succumbing to the disease, one was alive at the end of nine years, and one at the end of six years.

The average duration of life after the operation was 252.3 days. Two patients now under observation were living after two to three years, four after three to four years, and one after eleven years. 109 patients (31.8 per cent.) lived over a year after operation, and thirty-three (9.6 per cent.) over two years.

Epidural Injection in Enuresis.—KAPSAMMER (*Wiener klin. Wochenschrift*, 1903, Nos. 29 and 30) made 300 injections without a single accident. He used at first 5 cm. of cocaine solution (one-half of 1 per cent.), but subsequently found that normal saline solution produced the same result. The needle is inserted at the junction of the coccyx and sacrum, so that the solution reached the roots of the cauda equina without entering the dural sac. Usually one injection is sufficient. The result of the trauma is to stimulate the *nervus erigentes* and to restore the tone of the vesical sphincter.

Streptococci in the Normal Urethra.—ASAKURA (*Zentralblatt für die Krankheiten der Hern. med. Sexualorgane*, Band xiv., Heft 3) examined the secretions found in the fossa muscularis in 112 apparently healthy men and found the streptococci pyogenes present in fourteen (12.5 per cent.). This fact the writer regards as of especial interest to gynecologists, since it proves that streptococci may be introduced into the vagina during the sexual act.

The Operative Treatment of Cancer of the Uterus.—KLEIN (*Münchener med. Wochenschrift*, 1903, Nos. 11 and 12), after a careful study of the statistics, concludes that the percentage of cases (now 13.4 per cent.) can be still further increased by the earlier recognition of the disease by the general practitioner. To this end he should learn to diagnose the condition in its incipient stage. At the same time, the opposition of patients and their friends to early radical operation must be overcome. The laity should understand that cancer of the uterus is curable if attacked under the most favorable conditions.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

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The Use of a Mydriatic after the Age of Forty-five.—STARKEY, of Chicago (*Journal of the American Medical Association*, April 25, 1903), concludes that: "No age can be arbitrarily fixed beyond which cycloplegics must not be used, and while they are as necessary in certain cases after forty-five years as they are before, they are required in fewer and fewer cases as life advances. But since there is more danger of glaucoma in the elderly, and as mydriatics tend to increase intraocular tension, these drugs should be used with caution after the age of forty years, and in certain cases should not be used at all."

Of a number of ophthalmologists to whom questions bearing upon this point had been sent by the author, the majority agree in the main with the above conclusion.

Periscopic Lenses.—PERCIVAL, Newcastle-on-Tyne (*Arch. of Oph.*, July, 1903), gives the following table for the requisite curvatures of the two surfaces of periscopic lenses. These lenses will be accurately periscopic for all eccentric vision within a solid angle of 50 degrees between — 8 D. and — 14 D. For powers beyond this range extreme eccentric vision will not be so good as centric vision—*e. g.*, with a + 12 D. lens the vision will be distinct within a solid angle of 40 degrees—that is, 20 degrees on either side of the middle line. The index of refraction of the glass is assumed to be 1.54.

Power.	Anterior surface.	Posterior surface.
— 1 D.	+ 5.5 D	— 6.5 D
— 2 D.	+ 5 D	— 7 D
— 3 D.	+ 4.5 D	— 7.5 D
— 4 D.	+ 4 D	— 8 D
— 5 D.	+ 3.5 D	— 8.5 D
— 6 D.	+ 3 D	— 9 D
— 7 D.	+ 2.5 D	— 9.5 D
— 8 D.	+ 2 D	— 10 D
— 9 D.	+ 1 D	— 10 D
— 10 D.	Plane	— 10 D
— 12 D.	Plane	— 12 D
— 14 D.	Plane	— 14 D
— 16 D.	— 0.5 D	— 15.5 D
+ 1 D.	+ 6 D	— 5 D
+ 2 D.	+ 8 D	— 6 D
+ 3 D.	+ 10 D	— 7 D
+ 4 D.	+ 12 D	— 8 D
+ 5 D.	+ 13 D	— 8 D
+ 6 D.	+ 15 D	— 9 D
+ 7 D.	+ 16.5 D	— 9.5 D
+ 8 D.	+ 17.75 D	— 9.75 D
+ 9 D.	+ 19.5 D	— 10.5 D
+ 10 D.	+ 21 D	— 11 D
+ 12 D.	+ 23 D	— 11 D
+ 15 D.	+ 27 D	— 12 D

Intraocular Lipæma.—WHITE, of London (*Lancet*, October 10, 1903), reports a case of pronounced diabetes, in which the retinal vessels, both arteries and veins, contained blood of a deep cream color, passing into pale salmon in the larger vessels. The vessels appeared a little larger than usual. The whole retina was pale.

Examination of the blood taken during life showed that, in addition to a precipitated proteid, a substance was present which, although allied to fats, was not a true fat, so that the term "lipæmia" is not strictly correct. As the diabetes improved the color in both sets of vessels became more healthy, and, finally, quite natural.

Similar cases had been previously recorded by Heyl, *Transactions of the American Ophthalmic Society*, 1880; Fraser, *British Medical Journal*, May 23, 1903; and Reis, abstracted in the *Ophthalmoscope*, August, 1903.

Examination of 4608 Railroad Employes for Acuity of Vision, Hearing, and Color Perception.—MURRAY, of Scranton (*Annals of Ophthalmology*, January, 1903), found that of the above number 3.01 per cent. were color blind, 2.58 per cent. had weak chromatic sense, and 9.44 per cent. were in need of glasses or other means to improve their vision for distance.

OTOLOGY

UNDER THE CHARGE OF

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Ueber Horubungen Mittlest des Phonographen.—HERMANN GUTZMANN (*Monatsschrift für Ohrenheilkunde*, September, 1902) appreciates the strain upon the voice of the practitioner who undertakes exercises for the improvement of hearing. For this purpose he uses the phonograph. Tubes from the phonograph are placed in the patient's ears and all external sounds and influences excluded. The same exercise at different speeds and intensities are repeated as often as necessary.

The writer reports a case of a child, aged thirteen years, with catarrh of the middle ear as a result of scarlet fever at the age of five years. Since that time the child has developed slowly, is small for her age, head small and elongated, and nose narrow and palate high. A few adenoids present in the vault, she drags her feet when walking, and is slow to learn and is easily tired. The hearing in the left ear is absent. In the right ear tones above B are heard, and perception of the voice impossible, except upon shouting. The mechanical control of the tongue is poor, and in the production of the vowels *u*, *e*, *i*, they are often changed to *a*, *o*, etc. A phonograph was obtained and six cylinders, with letters in different sequences and intensities of tone, were used. In the beginning the vowel *a* was heard correctly; the other vowels and most of the consonants were heard incorrectly. After fifteen days all of the vowels were heard correctly, and a marked improvement in the voice production was evident.

The writer believes that the phonograph can be a great aid in vocal exercises and saves time and also strain upon the voice.—H. D. W.

The Pathological Anatomy of the Temporal Bone.—A. SONNTAG (*Monatsschrift für Ohrenheilkunde*, November, 1902) describes an interesting anomaly of the jugular fossa. The fossa usually extends to the level of the tympanic cavity. In this case he noticed that pressure upon the jugular vein caused a movement of the drum membrane. Investigating further he found that the bulb of the jugular was almost in apposition with the drum membrane and was covered only by mucous membrane. A large defect in the bone occupying part of the posterior half of the internal wall of the tympanum and part of the posterior wall as well was seen. The defect was kidney-shaped and about 9 mm. by 5 mm. in size. The sigmoid sinus was very far anterior. This coincides with Zuckerkandl's view that the deeper the jugular fossa the farther forward is the sinus.

Such a location of the jugular vein is extremely important in case of paracentesis; the danger of injury and infection is evident. The blue color of some membranes has been described, but it would be difficult to recognize such a case in an acute otitis media.

A second interesting specimen was one of complete ankylosis of the malleus and incus, so that the line of the joint could not be seen. Bridges of bone passed to the inner and anterior walls of the tympanic cavity. The promontory, stapes, etc., could not be identified. The mucous membrane was thickened and in the place of the drum membrane a thin layer of bone was found occupying its position. The process was evidently one of osteosclerosis.—H. D. W.

Ueber den Einfluss des Telephonierens auf das Gehoerorgan.—In an exhaustive review of this subject, BRAUNSTEIN (*Archiv f. Ohrenheilkunde*, B. lix., H. 3 und 4) not only collects the conclusions of other writers, but gives the results of his own observations, which were made to include the objective and subjective examination and the reported experience of a large number of telephone operators doing from six to eight hours continuous daily service in the telephone offices in Munich. The conclusion reached is in accord with that of the majority of the writers upon this subject, whom he quotes, and is to the effect that, aside from the mechanical effect of the constant wearing of a telephone headpiece and the influence upon the general nervous system of protracted strained attention, no deleterious effects were produced; on the other hand, there were instances in which, evidenced both by the experience of the telephone operators and by subjective examinations, the hearing, for sounds of moderate intensity, was improved. Of 450 operators examined, 150 had left the service; in no instance was this on account of the prejudicial influence of the telephone upon the hearing, and of those remaining in the service no one was liable to discharge because of increasing disability referable to continuance in the service.—C. J. B.

Recent Theories on Sound Conduction—TREITEL (*Archives of Otology*, vol. xxxii., No. 5) summarizes the recent contributions to the vexed question of sound transmission through the middle ear, in contradistinction to the theory of Helmholtz of the resonance value of the drumhead and the major transmission through the ossicular chain, and shows that both from a physical and a physiological basis molecule vibrations must be admitted as possible to explain both the limit of sound-perception in the human subject and the transmission through different media to the labyrinthine capsule.

Among the first to doubt the Helmholtz theory of the function of the drumhead and ossicles was Beckman, who sees in this so-called sound-transmitting apparatus only a dampening mechanism for the very unstable labyrinthine fluid, the equlibrium of which he claims is preserved through both the fenestral membranes; in the case of the round window by its elasticity, and in the oval window by adjustment of the complicated control apparatus, the drumhead, muscles of accommodation, and ossicular chain, of which the stapes forms the terminal member. The possibility of sound transmission through the round window as a direct route, Beckman does not admit, and the improvement in hearing by use of an artificial drum-membrane he explains, not by the

transmission to the stapes of a larger segment of the sound wave, but by the weighting, artificial control effect, upon the stapes itself. In support of this idea, Beckman further cites the considerable increase in hearing by bone-conduction, with slightly decreased hearing by air-conduction, in cases of acute otitis media with intact drumhead when the drumhead and malleo-incudal movements are partially inhibited and the stapes left, supposedly, free to act.

Zimmerman is of the same opinion as Beckman as to the dampening value of the drumhead and ossicular chain, but for sounds of major intensity only, not for ordinary sound-conduction, which he claims is direct through the promontory wall for all tones, because bone is the best conductor. This proposition leaves out of view the law governing the loss of force in the translation of sound waves from one medium to another, a loss which would variously affect the partials of any compound sound wave. As an offset to this is the claim that the equilibrium of the labyrinthine fluid is maintained only through the membrane of the round window, which, because of its structure and surroundings, can only be displaced outward and cannot be regarded as a medium for the transmission of sound waves in the opposite direction.

Zimmerman further questions the conclusions arrived at by Helmholtz and Politzer in their tests of the sympathetic movements of the individual ossicles by means of an organ-pipe tone, on the ground that the sounding body was hermetically attached to the external auditory canal and that the effects produced were those under increased air pressure; he denies, on both physical and physiological grounds, the capacity of the drumhead to react to sound of great amplitude of vibration, and regards the sympathetic vibration of the drumhead as a resonator membrane to all tones as impossible, and endeavors to explain, upon the basis of his theory of bone-conduction solely, the phenomena of lengthened bone-conduction in cases where the drumhead is absent, of improvement in hearing in such cases by application of an artificial drumhead and of paracusis.

Lucae, among others who seek to maintain the theory of sound-transmission through a middle-ear conducting mechanism, is directly opposed to the exclusive bone-conduction theory of Zimmerman, holding that while the sound waves pass directly to the labyrinth wall they are so dampened by the drumhead as to be inoperative, and that the round-window membrane is capable of responding to and transmitting sound waves, as demonstrated in the investigations of Johannes Müller.

Kleinschmidt regards the middle ear, including the mastoid cells, as an air chamber for the transmission of sound waves, the resonating effect of that cavity when filled with air under the normal condition of a patent Eustachian tube being a matter of little importance. He doubts the transmission of all notes through the ossicular chain, on account of the minimum amplitude of many of the appreciated tones, and also the ability of the accommodative muscles to act with a rapidity equivalent to the rapid succession of sounds, provided that the transmitting apparatus act as a whole. Accepting the proposition that the membrane of the round window can be set in vibration only by waves conveyed to it through the medium of the air in the middle ear, and that the stapes, with the drumhead, is actuated by low tones, this action coming later than the movement in the labyrinthine fluid due to movement of the membrane of the round window, he considers the ossicular

chain to have a dampening effect, the intrinsic muscles having no other office than that of protection of the labyrinth from excessive impulses.

Dennert, by experiments with tuning-forks vibrating in air and fluids, and Kaiser, by experiments with immersed telephones, seek to support the theory of Helmholtz, the former concluding that in air-conduction an external auxiliary apparatus especially adapted for the transmission of sound-vibration to the labyrinthine fluid is necessary, and the latter that while molecular vibration plays a part in the sound-transmission, the Helmholtz theory of mass-vibration is capable of normal acceptance.

The latest contribution to this discussion is the work of Secchi, who maintained more than ten years ago that the only access of sound waves to the labyrinth from the air in the middle ear was through the membrane of the round window, and who further maintains, as the result of clinical observations, supplementing laboratory experiments, that the drumhead serves only as a sound check or as a passive regulator of pressure, the ossicles, under action of the intrinsic muscles, regulating the intratympanic pressure during attentive hearing and serving as a protective apparatus against the effect of major excursions upon the labyrinth.—C. J. B.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Dwarf Tapeworm (Hymenolipsis Nana), a Newly Recognized and Probably Rather Common American Parasite.—STILES (*New York Medical Journal*, 1903, vol. lxxviii. p. 877). The dwarf tapeworm was first described in France by Dujardin, in 1845, as a parasite of the brown rat, but the term mus decumanus, which Dujardin gave to the parasite, cannot stand, since, in 1789, Gmelin used it for a different parasite. The correct name is hymenolipsis nana. About 100 cases have thus far been recorded in man, the greatest majority of them being reported from Sicily, where it is estimated that 10 per cent. of the children are infected. Before 1902 only two or three cases had been recognized in this country, but within the year the author has diagnosed the parasite in 18 infected individuals, living principally in the Southern States. Since September, 1902, the Hygienic Laboratory has examined about 3500 patients for intestinal parasites, and while "tænia solium" was not found in a single instance, and "tænia saginata" but twice, the dwarf tapeworm was discovered sixteen times. The dwarf tapeworm measures from one-fifth to slightly less than two inches in length; it has four suckers on the head and a crown of hooks. The presence of three testicles in each segment is characteristic for the genus hymenolipsis. The eggs are quite characteristic and have two distinct membranes. It

has been shown by Grassi and others that in rats the life cycle of this tapeworm takes place in the intestinal villi, and it is probable that in man autoinfection occurs, either per os and anum or by reverse peristalsis, development of the eggs through an intermediary host being unnecessary. The method of primary infection is not definitely known, but it is assumed that it occurs through the droppings of infected rats or mice in pantries and kitchens, where bread and other food may become contaminated. The dwarf tapeworm inhabits the ileum and may be present in thousands or only in very small numbers.

The symptoms produced by its presence are usually slight and may be absent altogether. Severe symptoms, however, such as persistent diarrhœa, epileptiform attacks, etc., occasionally are seen. Perhaps 10 to 12 per cent. of the cases exhibit severe nervous symptoms. The diagnosis is readily made by finding the characteristic eggs in the stools. Male fern is the only drug which has met with any degree of success in the treatment of the affection. Prevention of infection is secured by cleanly personal habits and by keeping mice and rats away from food supplies.

Localization of the Pneumococcus.—WANDEL (*Deut. Arch. f. klin. Med.*, 1903, vol. lxxviii. p. 1) reviews the literature concerning the localization of purulent infections secondary to pneumonia, and reports in detail four cases of acute pneumococcic endocarditis and three cases of pneumococcic pyæmia, with joint or heart lesions following chronic pneumococcic pneumonia. An attempt was made to trace the passage of the bacteria from the lung into the general blood stream. The fact that in pneumonia the bronchial glands are frequently swollen, and often hemorrhagic suggested that the pigmented lymph glands might act as a locus minoris resistentia for the development of the pneumococcus. In the above cases the lymph glands at the root of the lungs showed more or less coal pigmentation, with swelling and softening, and in one or two instances presented small abscesses. Pneumococci were found in great numbers in cultures and cover-slips from the pus of these abscesses, although they could only be grown in extremely small numbers from the lungs themselves. Under such conditions the normal filtration apparatus of the glands is materially interfered with, and bacteria are allowed to pass freely either into the thoracic duct or into the small bloodvessels of the lymph gland, thereby gaining entrance into the general circulation. This opinion was confirmed by microscopic examination, and the author believes that the origin of general systemic infections and purulent inflammations complicating pneumonia at a distance from the lungs is thus adequately explained.

A Delicate Test for the Demonstration of Bile Pigments in Urine.—JOLLES (*Deut. Arch. f. klin. Med.*, 1903, Bd. lxxviii. p. 135) has made certain modifications in the method which he formerly used to detect the presence of bile pigments in urine, and has found that this modification increases the reliability and delicacy of the reaction.

About 10 c.c. of urine are shaken in a test-tube with 2 to 3 c.c. of chloroform and 1 c.c. of a 10 per cent. solution of barium chloride. The mixture is then centrifugalized and the fluid above the sediment and chloroform drawn off with a pipette. Water is now added and the chloroform and sediment washed, the whole centrifugalized, and

the water removed by a pipette. Next 5 c.c. of alcohol are added and shaken well with the chloroform, after which 2 to 3 drops of an iodine solution are put into the mixture, and the whole filtered. If even the slightest trace of bile is present the fluid, after a few moments' standing, assumes a characteristic greenish color. If the urine is highly concentrated the reaction is best obtained by heating the mixture at 70° C. over a water bath before filtering. The reaction is not interfered with, either by indican or hæmoglobin. The iodine solution is prepared in the following manner: 0.63 gr. of iodine and 0.75 gr. of bichloride of mercury are dissolved separately in 125 c.c. of alcohol, the two solutions brought together, and the volume made up to 250 c.c. with concentrated hydrochloric acid. If the iodine solution is protected from the light in dark bottles it keeps indefinitely.

The Role of the Omentum in the Course of General Infections.—SIMON (*Presse Méd.*, 1903, T. ii. p. 726). It is already known that the omentum plays a very significant part in the cicatrization of abdominal wounds, in protecting torn or sutured peritoneal surfaces, and in walling off local infections of the peritoneum from the general cavity, but the changes in the omentum during a general infection have received but little attention. Simon found, after subcutaneous injections of lethal doses of diphtheria toxin, followed by injections of antitoxic serum, that the omentum reacted much as the spleen does under such conditions. Diapedesis of red blood corpuscles, migration of the polymorphonuclear leukocytes from the bloodvessels, and production of large phagocytic cells were noted, while, later, accumulations of plasma cells were seen about the bloodvessels. After four or five days the reaction subsides and the omentum gradually assumes its normal appearance.

The omentum in man was found to undergo much the same series of changes in diphtheria and in variola, although the intensity of the reaction varied somewhat in the individual cases. The author concludes that the omentum does not remain inert, even in general infections, and believes that it plays a definite part in the defence of the organism and probably in the development of immunity.

An Experimental Study of Nephrotoxins.—PEARCE (*Univ. of Penna. Med. Bull.*, 1903, vol. xvi. p. 217) says the subject of nephrotoxins has been studied in a somewhat superficial manner, particularly by the French and Italian observers, and the author in his work has repeated many of the experiments of Nefidieef, Castaign and Rathery, Ascoli and Figari, and others, frequently arriving at results which warranted conclusions quite different from those of the authors just cited. It was found impossible to produce an autonephrotoxin in rabbits or rats by several methods employed. Ligation of the ureter or of the entire pedicle of one kidney brought about only such lesions in the opposite kidney as occurred after unilateral nephrectomy, namely, a compensatory hypertrophy. It was equally impossible to produce an isonephrotoxin either by injections of serum from animals treated in the manner just described into other animals of the same species or by injecting serum produced by inoculating one animal's kidney into another animal of the same species. With heteronephrotoxins the conditions were found to be quite different. When the serum from a rabbit, which had been treated with successive doses of dog's kidney, was injected into

dogs, these animals developed a pronounced acute nephritis, evidenced by the appearance of albumin and numerous casts in the urine, together with a marked hæmoglobinuria. Control experiments made by injecting dogs with the serum of normal rabbits produced no such effect. Since the heteronephrotoxic serum was hæmolytic *in vitro* for dog's erythrocytes it was thought that possibly a part of the renal disturbance might be dependent upon this factor; and to exclude this possibility the dog's kidneys were thoroughly washed before the immunizing doses were given to rabbits. By this means a serum was produced in rabbits which set up an intense albuminuria with numerous casts, both conditions persisting for many days, but did not give rise to hæmoglobinuria. The histological lesions in the kidneys resulting from the injections of this toxic serum consisted in an extensive granular degeneration of the convoluted tubules and a fatty metamorphosis limited almost exclusively to the loops of Henle. Granular and hyaline casts were found in the tubules of the kidney, and minor changes occurred in the glomeruli. The heteronephrotoxic serum was found to be active after heating for half an hour at 56° C. Serum prepared from the cortex of the kidney proved to be much more toxic than that obtained by injections of the medullary portions. If the liver of dogs, instead of the kidney, was used for immunizing purposes a serum was obtained which gave rise to symptoms and lesions; when injected into dogs, similar to those called forth by inoculations of heteronephrotoxic serum. In the course of the experiments several dogs were found which were the subjects of a spontaneous nephritis; and it was discovered that their blood serum was capable of giving rise to an acute nephritis when injected into healthy dogs. This effect could be produced even to the second remove. All attempts to produce chronic renal lesions by successive inoculations of heteronephrotoxic sera were unsuccessful. No immediate effect was noted upon the blood pressure following injections of heteronephrotoxic sera into dogs or of isonephrotoxic sera into rabbits. From the foregoing experiments the author believes that the correlative action of different kinds of serum upon different body cells is demonstrable and that specificity is a function of receptors and not of cells in their entirety.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Effects of Compressed Air on the System.—Drs. Leonard Hill and J. J. R. Macleod (*Journal of Hygiene*, October, 1903, p. 401) have made an experimental study of the action of compressed air, which leads them to the conclusion that with proper choice of men and regulation of the shift and decompression period work can be carried on without loss of life at a depth as great as 200 feet, at which depth the pressure will exceed 100 pounds per square inch, or about 7 atmospheres. Their

experiments with animals show that compressed air above 5 atmospheres lessens the output of carbon dioxide and lowers the body temperature, and that oxygen at and above 1 atmosphere has the same effect. It is a sign of oxygen poisoning. Compressed air at 10 atmospheres is more damaging, at least to small animals, than oxygen at 2 atmospheres. It increases the loss of body heat, because it is a better conductor and because it is saturated with moisture. The saturation of the air in caissons with moisture does not prevent evaporation from the body, because the skin temperature is higher than that of the air, and the wet air increases the heat loss by dampening the clothes or fur. Highly compressed air may possibly interfere with the diffusion of carbon dioxide from the alveolar air, and may, owing to increased friction, hinder the passage of air in and out of the air-tubes. The nitrogen output in dogs is not altered in any noteworthy degree by exposure to 8 atmospheres for six hours. Inflammation and consolidation of the lungs are produced by exposure to 8 atmospheres for twenty-four hours, or to 1.5 atmospheres of pure oxygen; and the higher the oxygen tension the more rapidly the inflammation ensues. It does not seem likely that inflammation of the lungs is produced with the pressures and length of exposure usual in caissons. The cause of caisson sickness is the escape of gas bubbles in the bloodvessels and tissue fluids during decompression, but recompression causes them to go into solution again, and if it is applied quickly enough the circulation rebegins. After death following rapid decompression, the bubbles can be seen in the bloodvessels, heart, retinæ, aqueous humor, connective-tissue spaces, and elsewhere, and the alimentary canal is blown out with gas. The varying symptoms of caisson sickness are due to the varying seat of the air emboli. Owing to the elasticity of their tissues and to the greater facility for collateral pathways of circulation, young men escape the sickness, so that by choosing suitable men and regulating carefully the periods of compression and decompression, caisson and divers' sickness can be avoided. Gradual decompression is most important, and, provided two hours are spent in decompression, animals can safely be exposed to 8 atmospheres for four hours.

Factors which Determine the Local Incidence of Fatal Infantile Diarrhœa.—Dr. H. Meredith Richards (*Journal of Hygiene*, July, 1903, p. 325) calls attention to the fact that the various problems of infantile mortality are, with the continued fall in the birth rate, calculated to assume even greater practical importance in the near future, and that of these problems none is more in need of solution than the exact etiology of infantile diarrhœal diseases. He discusses the influence of methods of feeding, seasonal incidence and meteorological relations, influence of social status, physiography, pollution of the soil and its effects, and concludes that fatal infantile diarrhœa is usually a form of food-poisoning; that infection usually takes place at the home; that urban conditions are chiefly hazardous from the amount of polluted soil found in the roads and yards of urban districts; that infinite care is needed if babies are to be hand-fed in towns; and that practical preventive measures should include (*a*) impermeable roads with efficient channelling, (*b*) copious swilling of roads, (*c*) education of mothers as to the necessity of scrupulous cleanliness, (*d*) the co-operative or municipal provision of specially prepared modified milk, which should be sterilized

during the diarrhœal season, (*e*) a more efficient control of the milk trade, with special reference to the provision of cooled, approximately sterile milk from healthy cows, and (*f*) the provision of houses which shall be sufficiently convenient to allow of their being cleansed with the least possible expenditure of energy.

Dr. Arthur Newsholme (*Public Health*, August, 1903, p. 654) asserts that much of the relative immunity from diarrhœa at Brighton, England, in 1902, was due to the rainfall, for frequent rains during the summer weeks, even though the total fall be not great, is one of the most effectual means of keeping down the diarrhœa death rate. The obvious course to pursue is, then, in time of drought, to replace the natural scavenging of rain by municipal scavenging; that is to say, by wetting the dusty streets, thus converting the dust into mud, and gathering and removing the mud, rather than merely sprinkling water to lay the dust. With regard to soil temperatures at a depth of four feet, which are regarded as an important index of the possibility of prevalence of epidemic diarrhœa, he shows that Ballard's rule that diarrhœa must be expected when the soil temperature at a depth of four feet reaches 56° F. is fallacious, for on June 24th the temperature was 56° F.; on June 30th it was 58.4° F.; during the second half of July it was between 60° F. and 61° F.; in August it reached 61.8° F.; on September 10th it reached the maximum, 62.6° F., and then, slowly falling, it kept above 56° F. until October 19th, when it dropped to 55.8° F.; but no deaths occurred from diarrhœa, and, contrary to the rule, the highest number of deaths from diarrhœa occurred three weeks later than the week in which the soil temperature attained its mean weekly maximum. "The temperature conditions were favorable to diarrhœa; the rainfall prevented it. The facts for the present year justify the conclusion that rainfall is more important than temperature in relation to epidemic diarrhœa."

Dr. Herbert Peck, M. O. H. for Chesterfield (*Ibid.*, p. 655) is also of the same mind, for he ascribes the low death rate from diarrhœa in his district in 1902 in great part to the frequent showers. The amount of rain is of less importance than the number of showers, as is shown by a table of the rainfall for eight years. He concludes that frequent watering of the streets and roads in the more populous parts of the district would do much to prevent deaths from this cause.

[The first to call attention to the influence of rainfall on the death rate from diarrhœal diseases was Dr. E. W. Hope, who, in 1899, made known that at Liverpool during a period of twenty years the highest death rate occurred in the driest summer and the lowest in the wettest. The fourteen years in which the mean summer rainfall was 10.9 inches showed an average rate of about 50 per cent. higher mortality than the six wet years, with a mean rainfall of 13.8 inches for the corresponding months.—C. H.]

The Relation of Sulphur in Illuminating Gas to Air Vitiation.—The oppressive quality of air which is much vitiated by combustion of illuminating gas is the subject of an interesting contribution by Dr. J. S. Haldane (*Journal of Hygiene*, July, 1903, p. 382), who excludes the carbon dioxide produced by combustion and the attendant decrease in oxygen and increase in temperature as the causes thereof. The quantity of sulphur in ordinary gas is so small that his hypothesis that this substance is the cause of the unpleasantness may, he says, at first sight

seem improbable. English gas contains, as a rule, less than 20 grains of sulphur per 100 cubic feet, and hence, as gas forms about half its volume of carbon dioxide in burning, the products of combustion would contain less than ½ gram of sulphur per 500 litres of carbon dioxide, and this would yield about 1 gram, or ⅓ of a litre, of sulphur dioxide to 500 litres of carbon dioxide, or 1 volume in 1500. Hence, air vitiated by gas combustion to the extent of 30 parts of carbon dioxide per 10,000 would contain less than 0.02 sulphur dioxide, or 1 part in 500,000, which proportion is not very much smaller than Lehmann found would produce perceptible irritation of the nose and throat. Part of the sulphur is, however, in Haldane's opinion, present as sulphuric acid and in a particulate form, in which condition it has not the same specific taste as sulphurous acid, but is extremely irritating and unpleasant. In order to investigate the relation between the proportion of sulphur in gas and the unpleasantness of air vitiated by the products of combustion, he made a series of experiments, which proved that the degree of unpleasantness varies directly with the amount of sulphur, and that gas which is purified of its carbon disulphide is greatly superior, from the hygienic standpoint, to that which is purified only of its hydrogen sulphide. Unfortunately, no process is known which will remove all of the sulphur from gas; but were it possible to do this, there would be no objection to the free use of gas for both heating and lighting and to the escape of the products of combustion into the room. He found that the air of a room in which good oil was burned in a lamp was not noticeably unpleasant, apart from the heat, even where the carbon dioxide rose to 75 parts per 10,000; but that when gas was burned the air was distinctly unpleasant when vitiated to the extent of 30 to 40 parts of carbon dioxide per 10,000, and very unpleasant when this impurity rose to 60 parts.

The Relationship of Human and Bovine Tuberculosis.—Messrs. D. J. Hamilton and J. McLauchlan Young (*Transactions of the Highland and Agricultural Society of Scotland*, 1903, and *Public Health*, September, 1903, p. 689) undertook a series of twenty experiments designed to test the validity of the assertion that human tuberculosis differs so much from bovine that it cannot be transmitted to calves, and arrived at the following conclusions: 1. Although human tuberculosis is probably not so virulent for the calf as that derived from bovines, yet it can readily be inoculated upon that animal. 2. This holds good whether the tubercle inoculated be derived from tubercular lymph glands, tubercular lung, tubercular sputum, or tubercular urine. 3. It produces this positive result irrespective of whether it be introduced by feeding the animal with the tubercular material, by subcutaneous inoculation upon a peripheral part, by respiring a spray containing the bacillus, or by injection into the venous system. 4. The organs most affected are those in immediate connection with the part operated upon. 5. The lymphatic system is constantly involved in the resulting tuberculosis. 6. When administered by the mouth, tubercular sputum induces an abdominal lymph-gland tuberculosis without necessarily involving the intestine in any way. 7. When tuberculosis from a human source has been ingrafted upon a calf, it grows enormously in virulence by being reinoculated upon a second calf. 8. The morphological characters of the bacillus may vary according to circumstances, and are no

guide to the source of the organism under observation. 9. The above facts go to favor the view that the human bacillus and that of bovines are identical, but modified somewhat by their environment, and directly contradict the results alleged to have been obtained by Koch and Schütz.

Prophylaxis of Malaria.—At the Eleventh International Congress of Hygiene and Demography, at Brussels, September 2–8, 1903, PROFESSOR A. CELLI recommended as prophylactic measures against malaria the production of artificial immunity by means of quinine, disinfection of the blood of malarial persons with quinine, mechanical protection of dwellings and of exposed parts of the body, isolation of patients, destruction of anopheles, and drainage for the destruction of their breeding places. For the production of artificial immunity, he recommended either daily doses of 5 or 6 grains of quinine (children half as much) or weekly doses of 15 grains on Saturday and Sunday evenings. The daily dose is more efficient and less unpleasant, and its action is cumulative and produces an almost complete mithridatism. The specific disinfection of the blood requires long treatment and especial care in pre-epidemic times. The Italian Government prepares quinine salts and sells them throughout the kingdom at lowest prices to apothecaries, tobacconists, and salt dealers. The peasants who work in malarial districts are supplied free of cost to themselves, the landowners being charged for it. Laborers on public works can have all they need, and the contractors for whom they work are held accountable for all deaths due to lack of supply.

The Use of Chemical Preservatives in Foods.—In a communication before the International Congress of Medicine, at Madrid, PROFESSOR BROUARDEL (*Annales d'hygiène publique et de médecine légale*, 1903, vol. xlix. p. 420) maintained that the claim made by those interested in the addition of chemical preservatives to foods, that the amounts employed are too small to produce harmful results, and that the substances used cannot be classed as harmful, because they are employed extensively as drugs in medical practice with good results, should be quite ignored and disregarded. He relates that Dubrisay has reported the finding of as much as 2 grams of salicylic acid per litre of wine, 1.25 grams per litre of beer, and 1.6 grams per kilo of butter. He regards the establishment of a maximum permissible amount of antiseptics as not worthy of consideration, since prolonged use of them may act injuriously and escape detection as the real offender. That acute poisoning has not been observed is no argument in their favor, for obviously any substance which could cause acute symptoms in the amounts used would be avoided.

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